CONESTOGA-ROVERS & ASSOCIATES

1811 Executive Drive, Suite O
Indianapolis, Indiana 46241
Telephone: (317) 381-0677 Fax: (317) 381-0670
www.CRAworld.com

TRANSMITTAL

DATE: August 2, 2006

REFERENCE NO.: 013307

PROJECT NAME: Caterpillar - Mapleton

TO: Mr. Steve Johnson
U.S. EPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604

Please find enclosed:
- ☐ Draft
- ☒ Originals
- ☐ Prints
- ☐ Final
- ☐ Other

Sent via:
- ☐ Mail
- ☒ Overnight Courier
- ☐ Same Day Courier
- ☐ Other

QUANTITY	DESCRIPTION
3	Remediation Investigation/Feasibility Study
	Land West of Building B
	Caterpillar Inc. - Mapleton, Illinois

- ☒ As Requested
- ☒ For Your Use
- ☐ For Review and Comment
- ☐
- ☐

COMMENTS:

Copy to:

Completed by: Steve Wanner/sl/15
[Please Print]

Signed: [signature]

Filing: **Correspondence File**

CONESTOGA-ROVERS & ASSOCIATES

6520 Corporate Drive
Indianapolis, Indiana 46278
Telephone: (317) 291-7007 Fax: (317) 328-2666
www.CRAworld.com

TRANSMITTAL

DATE: June 3, 2010

REFERENCE NO.: 013307

PROJECT NAME:

TO: Ms. Jean Greensley
U.S. Environmental Protection Agency
Remediation and Reuse Branch - Region 5 LU-9J
77 West Jackson Boulevard
Chicago, IL 60604-3590

rec'd 6/7/10

Please find enclosed: ☐ Draft ☒ Final ☐ Originals ☐ Other ☐ Prints

Sent via: ☐ Mail ☐ Same Day Courier ☒ Overnight Courier ☐ Other

QUANTITY	DESCRIPTION
1	CD containing RCRA Investigation/Feasibility Study - Swale Area
	Caterpillar Inc.
	Mapleton, Illinois

☐ As Requested ☒ For Review and Comment
☒ For Your Use ☐
☐

COMMENTS:

Copy to: G. Bevilacqua, Caterpillar
J. McPherson, Caterpillar
D. Riehl, Caterpillar
J. Bromm, Caterpillar

Completed by: Benita Robinson/21 [Please Print] Signed: Benita Robinson

Filing: Correspondence File

317-291-7005

6/16/10

Steve Wanner - CRA

1:30 pm

J. Greensley - EPA

Caterpillar - Mapleton, Il

Swale area

Caterpillar will redevelop wells - gw data
creation of figure to delineate hotspots
will get info on thickness of concrete
will get financial info regarding disposal
- should take couple weeks to put together

Cwbb

Carved out by Cat. as an area to be divested -
idea was to get a risk-based closure
1) keep it industrial
2) use development as capping
} all fallen through

no recent interest - no mixed. interest
premise of doc. to do rifts with intent to
risk-based closure

Steve will create a figure showing the pcb contamination
relative to concentration, eg 1 ppm, 10 ppm, etc.
- contam. is less than 25 ppm
- per Steve's visual - no contam. - report on concrete

145

CATERPILLAR

Caterpillar Inc.

Mapleton, Illinois 61547

Caterpillar Inc.
CMO - Mapleton Foundry
8826 W US Hwy 24
Mapleton, IL 61547

August 1, 2006

Steve Johnson
US EPA Region 5
77 W. Jackson Blvd.
Chicago, IL 60604

Re: Caterpillar Mapleton Facility
PCB Remediation

Dear Mr. Johnson:

On behalf of Caterpillar, I thank you for meeting with us last September to discuss Caterpillar's proposed Remedial Investigation/Feasibility Study ("RI/FS") for the historical PCB contamination at the Caterpillar Mapleton facility. We believe our meeting was productive, and our discussions have proven helpful to us in our subsequent assessment efforts at the site.

Since our meeting, Caterpillar has performed substantial additional assessment at the site, including investigation of the timing of historical disposal activities, and completion of a revised Human Health Risk Assessment ("HHRA"). The revised HHRA evaluates commercial/industrial use for the Land West of Building B ("LWBB"), in addition to the current low occupancy usage. As a result of these additional assessment efforts, Caterpillar has prepared a revised RI/FS (attached hereto), applicable to the LWBB, which we submit for your review. A separate, revised RI/FS for the Swale Area will be prepared at a later date. As further described below, based on the timing of disposal at the LWBB, risk-based closure of the LWBB is likely not necessary. Nevertheless, as set forth in the revised RI/FS, the HHRA demonstrates that the risk levels for the LWBB are within USEPA's acceptable range under both the current usage and commercial/industrial usage scenarios.

Our investigation of historical disposal activities at the LWBB has revealed that filling of the land between Building B and Little LaMarsh Creek occurred between 1967 and 1974. Under 40 CFR 761.50(b)(3), sites containing PCB waste that was placed in a land disposal facility, spilled, or otherwise released to the environment prior to April 18, 1978 are presumed not to present an unreasonable risk of injury to health or the environment from exposure to PCBs, and not to require further disposal action. 40 CFR 761.50(b)(3)(A), *see also* 63 FR 35384, 35401.

Caterpillar believes that, based on the pre-April 1978 disposal date at the LWBB, risk-based closure of this area pursuant to 40 CFR Part 761 is likely not required.

Despite the likely inapplicability of the risk-based closure requirements of 40 CFR Part 761, Caterpillar has completed a revised HHRA for the LWBB in accordance with the National Contingency Plan and applicable U.S. EPA guidance. The revised HHRA evaluates the risks associated with the site under current usage, and under a commercial/industrial usage scenario. The results of the HHRA demonstrate that risk levels were within or below U.S. EPA's acceptable risk range for both current site conditions and the future industrial/commercial use exposure scenario. Future industrial/commercial use is contingent upon the imposition of deed restrictions to ensure proper notice to future site owners of the land use limitations.

In summary, given the pre-1978 disposal date for the LWBB, risk-based closure is likely not required at the Mapleton facility. Nevertheless, Caterpillar has completed a human health risk assessment which demonstrates that, under present conditions, the site does not pose an unacceptable risk, and that no further remediation is required. Further, the site is suitable for redevelopment for commercial/industrial purposes, provided proper deed restrictions are established.

We request that you confirm the acceptability of the revised RI/FS for the LWBB, and the HHRA contained therein. We further request that you confirm that no further remediation is required with regard to PCB wastes in this area, and that the site is suitable for future commercial/industrial development, provided appropriate deed restrictions are established.

Thank you again for your consideration. Should you have any further questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Jason Keeling

Jason Keeling
Utilities and Environmental Manager
CMO - Mapleton Foundry
Caterpillar, Inc.

cc: David Codevilla, Corporate Legal
Mike Warnken, Facility Manager, Mapleton
Gary Conner, Corporate EHS
Steve Wanner, Conestoga – Rovers & Associates

Versar inc.

MEMORANDUM

TO:	Tom Simons, EPA	cc:Linda Phillips 4600.3000.005
FROM:	Chris Greene	
DATE:	12/3/2001	
SUBJECT:	PCB Risk Assessment Study Review	

The following is a summary and review of *Remedial Investigation/Feasibility Study, Caterpillar Inc., Mapleton, Illinois*.

SUMMARY

The Caterpillar, Inc. site in Mapleton, Illinois contains a foundry used to manufacture engine blocks, cylinder heads, liners, and camshafts. A 1998 investigation of a former RCRA drum storage area in one area of the site revealed the presence of PCBs in the soil. After further investigation indicated the presence of PCBs in areas adjacent to the drum storage area, a more extensive investigation of the site's soil and groundwater was begun. Two areas were studied: The 14-acre "Swale area" and the 25-acre parcel of "land west of Building B" (LWBB). The Swale area is a low-lying area bounded by man-made fill material and a railroad line; during the 1970's it was a disposal area for foundry sand. The LWBB is a vacant area that lies between Little LaMarsh Creek and the manmade clay fill that underlies the 1,000,000-square-foot Building B.

The report indicates that the LWBB area qualifies as a low-occupancy area under 40 CFR 761.3 and the maximum PCB concentration in the soil was 8.2 ug/g, based on a total of 47 samples collected at a variety of depths from 12 soil borings. PCBs were detected in nine of the twelve soil borings. Because the maximum soil concentration did not exceed the cleanup criterion for bulk PCB remediation for a low-occupancy area, no active remediation was required for this location. Instead, access controls and deed restrictions will be used to prevent future development of the site.

The Swale Area study included 93 soil samples collected from 22 soil borings by a contractor. Pond?
Samples were collected in December 1998, February 1999, and September 1999. PCBs were

detected in 20 of the 22 borings and in 72 of the 93 soil samples. In addition, groundwater samples were collected from varying depths in three monitoring wells in December 1999 and January 2000. PCBs were not detected in these samples (at a detection limit of 1.0 ug/L).

A human health risk assessment was carried out for the Swale and LWBB areas. The exposure scenarios examined in the risk assessment were (1) Current/future trespasser exposure (adolescents), (2) Current/future Industrial worker exposure to surface soil, (3) future construction worker exposure to soil, (4) Current/future trespasser exposure to ambient air (adolescents), (5) Current/future industrial worker exposure to ambient air, and (6) Future construction worker exposure to ambient air. Residential exposures were not considered because the site is in a rural area and there is little likelihood of future residential development. Deed restrictions to prevent residential development were included in the proposed corrective action.

The risk assessment included both sets of soil data (those collected by Caterpillar in the 1998 drum storage area study and those collected by the contractor in 1998 and 1999). PCBs were identified as contaminants of potential concern based on their elevated concentrations in soil. Standard exposure factors were used, with one exception: exposure times for workers were reduced to 6.7 hours per week, which is consistent with the area's status as a low-occupancy area. This figure corresponds to the upper limit of occupancy time under the definition of low-occupancy areas in 40 CFR 761.3.

The highest carcinogenic risks at the site were for the trespasser and industrial worker exposure scenarios for surface soil in the Swale Area and the construction worker scenario for total soil in the Swale Area. For each of these scenarios, the RME carcinogenic risks were between 10^{-6} and 10^{-5}. No CTE carcinogenic risks exceeded 10^{-6} for any scenario. Some multiple pathways were also considered. These included combining the Swale Area and LWBB exposures for trespassers and construction workers, based on the assumption that the same individual could be exposed to the contamination at both sites. The combined risks did not exceed the 10^{-4} to 10^{-6} range and the combined hazard indices did not exceed 1.

Four alternatives for the site were considered. The study concluded that a simple approach of implementing deed restrictions, access controls, monitoring, and maintenance would be sufficient to protect human health and comply with the law. Additional measures such as capping, excavation, and/or offsite landfilling of the contaminated soil were considered unnecessary at this site, and a simpler option of doing nothing would be insufficient to prevent trespasser exposure. The estimated cost of the proposed solution is $980,000.

COMMENTS

Overall, the study follows all appropriate protocols and is thorough and complete. The following are some specific comments that came up during the review.

Section 4.4 states that the groundwater samples were all nondetects. However, the detection

limits reported in Appendix G are 1.0 ug/L. This DL exceeds the Region III risk-based concentrations for all of the Aroclors. Therefore, the nondetects do not necessarily indicate the absence of risk. The potential for human exposure to groundwater should therefore be included in the risk assessment. The groundwater results, with detection limits, should be included in a table in Section 4 similar to the tables that present the soil analytical results.

According to p. 27-28 of the report, "all analytical soil data collected from the study area for both the Caterpillar and the CRA Site investigations has been used in the RA to estimate Risks and hazards to potential human receptors." However, Table 2.1 in Appendix H only includes the CRA data. Why was the Caterpillar data included for "soil" (Table 2.3), but not "surface soil" (Table 2.1)?

"Surface soil" and "Total soil" were assessed, but not "subsurface soil" by itself. Would this affect the results at all? The construction worker scenario could involve contact with subsurface soil. The text should explain why the soil data were grouped in this way.

On page 31-32, the report states that because PCBs have a tendency to sorb strongly to organic matter, the groundwater pathway is incomplete. The report should include a citation for this statement.

On page 40, the reference to Tables 5.1 and 5.2 should state that they are in Appendix H.

On page 28, the report states that the concentrations of all Aroclors were summed to produce a total PCB concentration. Rather than using half detection limits for nondetects, the submitter omitted the nondetects.

On page 36, the report states that the trespasser body weight is 45 kg, referencing Table 7-5 of the Exposure Factors Handbook (EPA, 1997). This number is said to represent the mean body weight for males age 8-17. However, it is Table 7-6 and Table 7-7 that contain these data for boys and girls, respectively. The mean values for boys and girls ages 8-17 are 46.7 and 44.7 kg, respectively. Did the submitter take the mean of boys and girls?

The 95% UCL of the mean is typically used for both reasonable maximum exposure (RME) and central tendency (CT) assessments. However, on page 32, the report states that the 95% UCL of the mean was used as the RME EPC, but the unadjusted mean was used for the CT EPC. This could result in an underestimate of the CT exposure value.

On page 32 (and in the corresponding tables in Appendix H), the report references the "Shapiro Wilks" test for normality. According to the reviewer's reference, the name is actually Shapiro-Wilk. (ref. Gilbert, R.O., 1987, *Statistical Methods for Environmental Pollution Monitoring*, New York: Van Nostrand Reinhold.) The calculations for the Shapiro-Wilk test should be included in an appendix.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

File copy

REPLY TO THE ATTENTION OF:

DEC 0 7 2009

LU-9J

Mr. Steve Wanner
Conestoga-Rovers and Associates
1811 Executive Drive
Suite O
Indianapolis, Indiana 46241

RE: August 2, 2006 Remedial Investigation/Feasibility Study
Land West of Building B
Caterpillar, Inc., Mapleton, Illinois

Dear Mr. Wanner:

The U.S. Environmental Protection Agency has reviewed information you submitted regarding PCB contamination at the Caterpillar Facility in Mapleton, Illinois (site). Your assessment of the site has shown there are PCBs in the vicinity of the land west of Building B (LLWB), the swale area and the former drum storage area. The focus of this letter is the remediation of the PCB contamination material in the LLWB.

From the information in the August 2, 2006 Remedial Investigation/Feasibility Study (RI/FS), the PCB contamination in the LLWB is less than 25 ppm. Under the self-implementing portion of the PCB regulations at 40 CFR § 761.61(a), the PCB contaminated material can remain in the LLWB provided it is classified as a low occupancy area. This means that occupancy for any individual not wearing dermal and respiratory protection is limited to less than 335 hours per calendar year or an average of 6.7 hours per week.

To pursue a cleanup approval under 40 CFR § 761.61(a), the owner of the property must submit a letter to EPA notifying us of his intent to remediate the site in accordance with the self-implementing standards of the PCB regulations. The notification should reference the previously submitted RI/FS and the proposed cleanup level for the LLWB portion of the site. The owner must include a written certification that states that all sampling plans, sample collection procedures, sample preparation procedures, extraction procedures, instrumental/chemical analysis procedures, used to assess or characterize the PCB contamination at the cleanup site, are on file at the location designated in the certificate, and are available for EPA inspection. This statement must be signed by the owner of the property and the party conducting the cleanup.

The owner must send the letter and certification statement to Jose G. Cisneros, Chief of the Remediation and Reuse Branch (Mail Code LU-9J) at least 30 days before he intends to

initiate cleanup of the property. The State and local government also must receive a 30 day notification. To satisfy this requirement, the owner must submit to the State and local government a copy of his letter to EPA, the certification statement and the RI/FS. EPA can waive the 30 day notification requirement but only if the State and local government informs EPA that they waive the 30 day notification.

Remediation of the LLWB will not address the PCB contamination in excess of 50 ppm at the site. EPA expects you to submit a work plan for the remediation of the swale and former drum storage area. Please let me know when we can expect this information. In addition, EPA would like you to sample the Building B concrete pad for PCBs. Keying in on stained areas, collect at least 20 milliliters of material from a core sample that is no more than 2-3 centimeters in diameter. The maximum depth of the core should not exceed 7.5 centimeters (40 CFR § 761.286). You must document and submit these results to EPA. You may choose to include the concrete pad investigation as part of the LLWB cleanup or address it separately.

If you have any questions or wish to discuss the information in this letter, please do not hesitate to contact me at 312-353-1171.

Sincerely,

Jean M. Greensley

Jean M. Greensley, Geologist
Corrective Action Section I
Remediation and Reuse Branch

CONESTOGA-ROVERS
& ASSOCIATES

6520 Corporate Drive
Indianapolis, Indiana 46278
Telephone: (317) 291-7007 Fax: (317) 328-2666
www.CRAworld.com

MEMORANDUM

TO:	Jean Greensley, U.S. EPA	REF. NO.:	013307
FROM:	Steven J. Wanner/sw/016	DATE:	September 24, 2010
C.C.:	John McPherson, Caterpillar Judy Gagnon, Caterpillar		
RE:	**Swale Area Remedial Investigation/Feasibility Study (RI/FS) Report Caterpillar Inc. Cast Metals Organization (CMO), Mapleton, Illinois**		

Per your request during our conversation on June 16, 2010, Conestoga-Rovers & Associates (CRA) has compiled the following information on behalf of Caterpillar Inc.:

- two figures depicting polychlorinated biphenyls (PCBs) isoconcentration plots in the Swale Area in the 0 to 2 feet and greater than 2 feet below ground surface intervals (Figures 1 and 2)
- two figures depicting PCB isoconcentration plots in the Land West of Building B (LWBB) Area in the 0 to 2 feet and greater than 2 feet below ground surface intervals (Figures 3 and 4)

In addition, you requested that a cost estimate be prepared for an excavation and off-site disposal option for the Swale Area. The purpose of this estimate would be to assist the U.S. EPA in evaluating the proposed remedy for the Swale Area. CRA evaluated the excavation and off-site disposal of soil containing PCBs above 100 parts per million (ppm). The area containing PCBs at a concentration above 100 ppm is depicted in Figure 5. The attached Table 1 provides a summary of estimated costs for excavation and off-site disposal option.

As we discussed, the site-specific risk assessment provided in the Swale Area RI/FS indicated that the risks do not warrant expensive options such as excavation and off-site disposal of soil. This information is provided in the context that it would be of use to the U.S. EPA in evaluating the remedies that are identified in the Swale Area RI/FS Report.

Additionally, you inquired about the status of the three wells installed during the Swale Area RI/FS, as the U.S. EPA would like another round of groundwater samples from these wells to update the conditions at the site. During our call, I explained that we would need to conduct an inspection to verify this and check on the condition of the wells. We have completed this inspection and have verified the three monitoring wells (MW-99A, MW-99B, and MW-99C) are in good condition. Therefore, Caterpillar agrees to redevelop and sample these monitoring wells. It is anticipated that this well development/groundwater sampling will be conducted this fall. Groundwater samples will be collected and analyzed for PCBs.

I will contact you and advise you of the specific schedule once it has been set. In the meantime, please feel free to contact me with any questions concerning this matter.

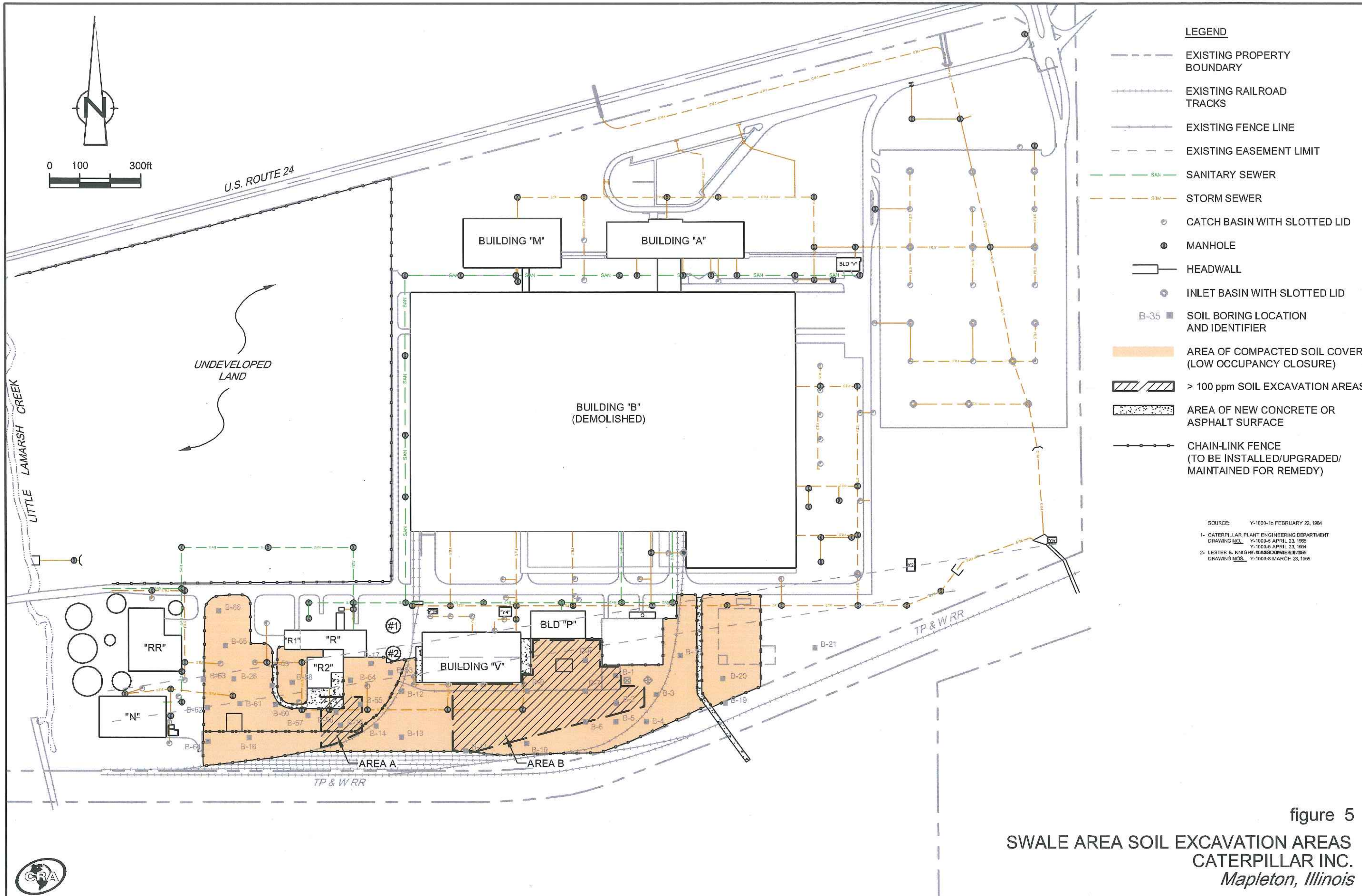
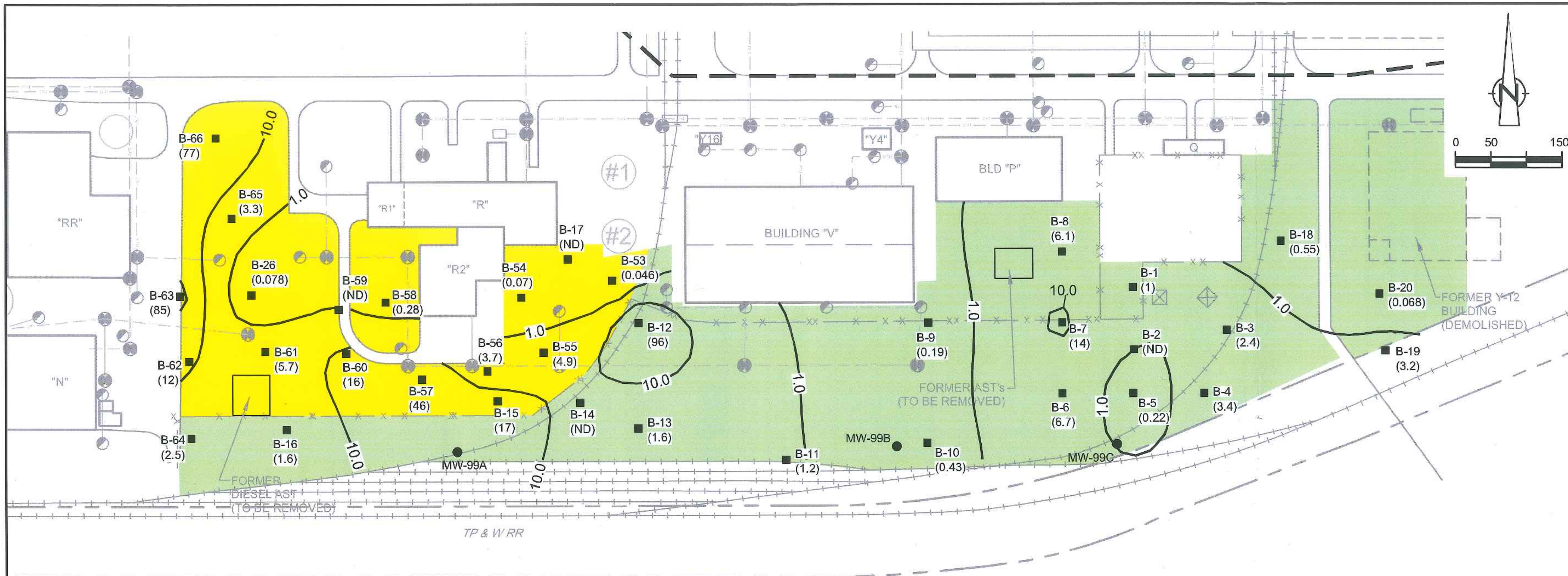
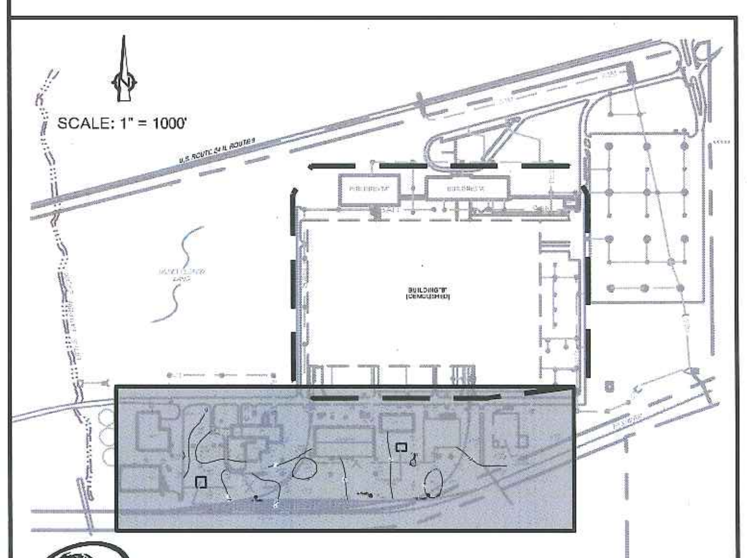


figure 5

SWALE AREA SOIL EXCAVATION AREAS
CATERPILLAR INC.
Mapleton, Illinois

13307-00(MEMO016)GN-WA005 JUL 30/2010





KEY MAP

LEGEND:

	EXISTING PROPERTY BOUNDARY
	EXISTING RAILROAD TRACKS
	EXISTING FENCE LINE
	OUTLINE OF DEMOLISHED BUILDING
	SANITARY SEWER
	STORM SEWER
	CATCH BASIN WITH SLOTTED LID
	MANHOLE
	HEADWALL
	EAST SWALE AREA
	WEST SWALE AREA
	INLET BASIN WITH SLOTTED LID
	CLAY-CORE DIKE
B-35	SOIL BORING LOCATION AND IDENTIFIER
MW-99A	SWALE AREA MONITORING WELL LOCATION AND IDENTIFIER
1.0	PCB CONCENTRATION CONTOUR
(1.60)	PCB CONCENTRATION IN SOIL
ND	NOT DETECTED

SOURCE:

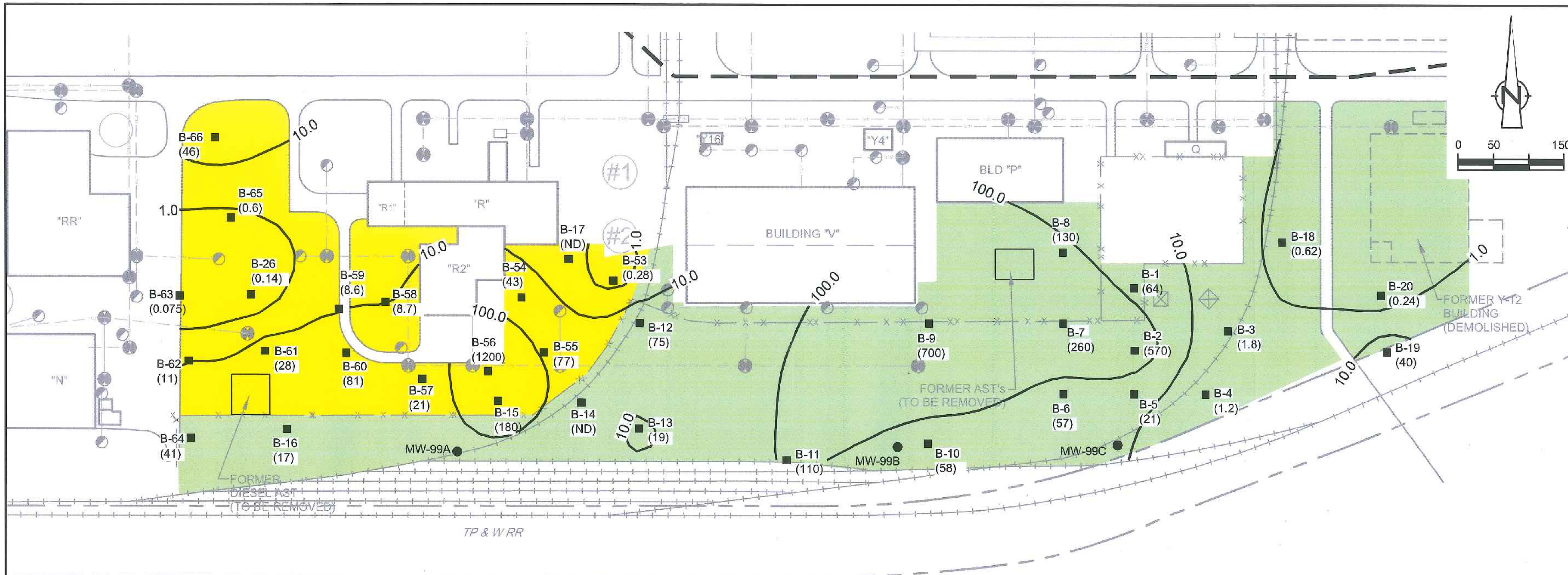
1- CATERPILLAR PLANT ENGINEERING DEPARTMENT DRAWING NO. Y-1000-1b FEBRUARY 22, 1984

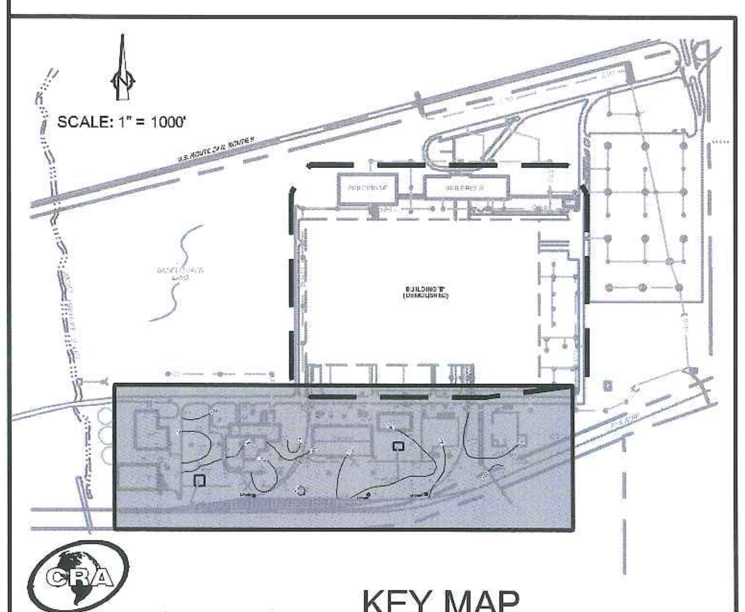
2- LESTER B. KNIGHT & ASSOCIATES, INC. DRAWING NOS. Y-1000-5 APRIL 23, 1965
Y-1000-6 APRIL 23, 1964
Y-1000-7 APRIL 23, 1965
Y-1000-8 MARCH 23, 1965

figure 1

SWALE AREA SOIL ISOCONCENTRATION MAP 0 TO 2 FT BELOW GROUND SURFACE
CATERPILLAR INC.
Mapleton, Illinois

13307-00(MEMO016)GN-WA001 JUL 30/2010





LEGEND:

EXISTING PROPERTY BOUNDARY

EXISTING RAILROAD TRACKS

EXISTING FENCE LINE

OUTLINE OF DEMOLISHED BUILDING

SANITARY SEWER

STORM SEWER

CATCH BASIN WITH SLOTTED LID

MANHOLE

HEADWALL

EAST SWALE AREA

WEST SWALE AREA

INLET BASIN WITH SLOTTED LID

CLAY-CORE DIKE

B-35 SOIL BORING LOCATION AND IDENTIFIER

MW-99A SWALE AREA MONITORING WELL LOCATION AND IDENTIFIER

1.0 PCB CONCENTRATION CONTOUR

(1.60) PCB CONCENTRATION IN SOIL

ND NOT DETECTED

SOURCE:

1- CATERPILLAR PLANT ENGINEERING DEPARTMENT DRAWING NO. Y-1000-1b FEBRUARY 22, 1984

2- LESTER B. KNIGHT & ASSOCIATES, INC. DRAWING NOS. Y-1000-5 APRIL 23, 1965
Y-1000-6 APRIL 23, 1964
Y-1000-7 APRIL 23, 1965
Y-1000-8 MARCH 23, 1965

figure 2

SWALE AREA SOIL ISOCONCENTRATION MAP > 2 FT BELOW GROUND SURFACE
CATERPILLAR INC.
Mapleton, Illinois

13307-00(MEMO016)GN-WA002 JUL 30/2010

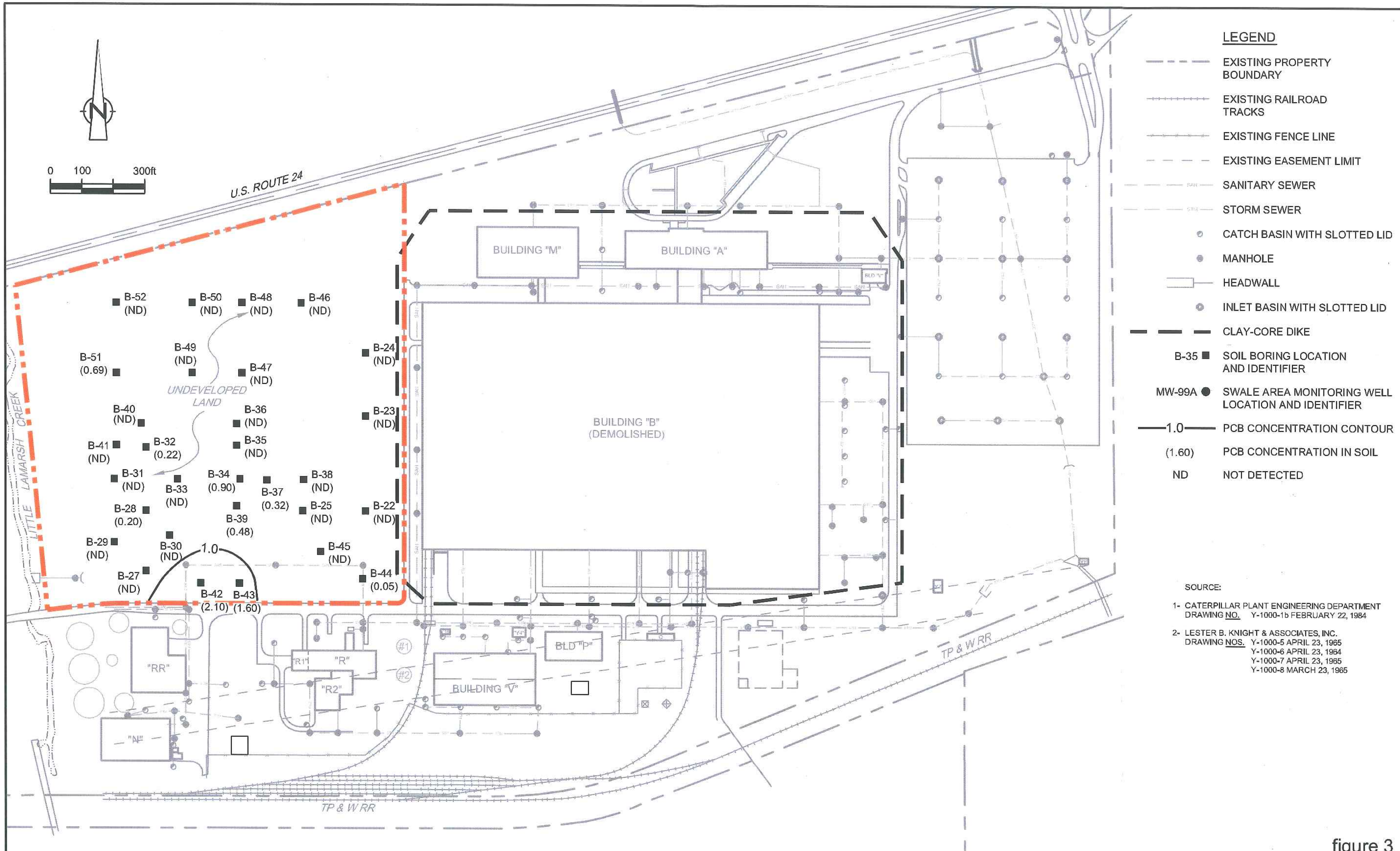


figure 3

LWBB AREA SOIL ISOCONCENTRATION MAP 0 TO 2 FT BELOW GROUND SURFACE
CATERPILLAR INC.
Mapleton, Illinois

13307-00(MEMO016)GN-WA003 JUL 30/2010

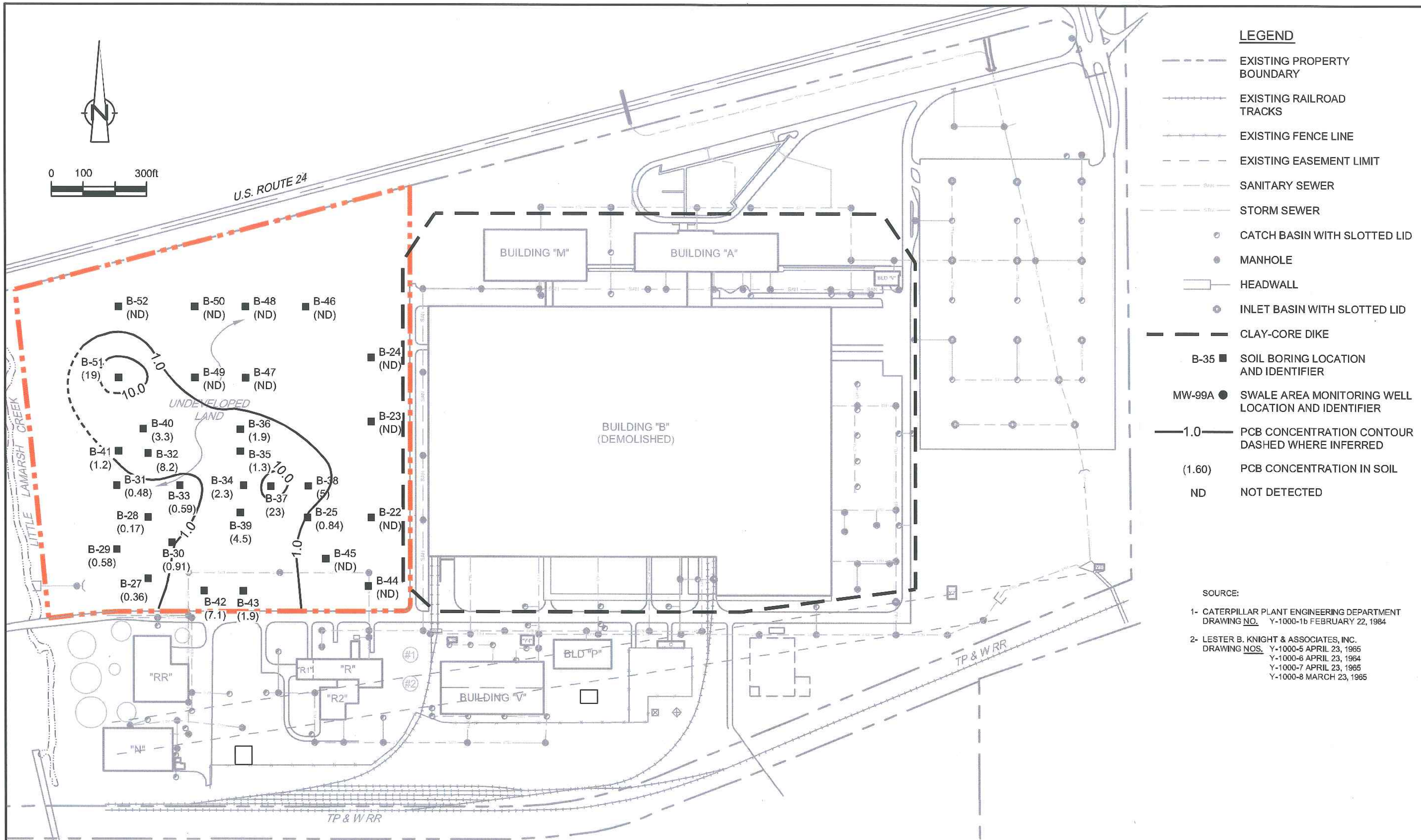


figure 4

LWBB AREA SOIL ISOCONCENTRATION MAP > 2 FT BELOW GROUND SURFACE
CATERPILLAR INC.
Mapleton, Illinois

13307-00(MEMO016)GN-WA004 JUL 30/2010

TABLE 1

COST PROJECTION
ALTERNATIVE 4 - PARTIAL EXCAVATION/DISPOSAL AND CAPPING/ VEGETATIVE COVER
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Description	*Units*	*Quantity*	*Unit Price*	*Total*
Subgrade preparation	SY	2,100	$1.60	$3,360
Asphalt Access Road - Landfill Access Road				
Asphalt placement (4 in. binder + 3 in. surface)	SY	1,000	$17.50	$17,500
Base course placement with fabric (12 in. rock)	SY	1,000	$14.50	$14,500
Subgrade preparation	SY	1,000	$1.60	$1,600
Security				
Fencing and Signage (6' chain link) (Swale Area and Land West of Building B)	LF	8,000	$25.50	$204,000
			Subtotal	**$9,540,000**
Project Administration				
Bonds and Insurance	%	2	$190,800.00	$190,800
Mobilization/Demobilization	%	5	$477,000.00	$477,000
Permits	%	2	$190,800.00	$190,800
Health and Safety	%	3	$286,200.00	$286,200
Construction Facilities and Temporary Controls	%	1	$95,400.00	$95,400
			Subtotal	**$10,780,200**
			Engineering (20%)	**$2,156,040**
			TOTAL CAPITAL CONSTRUCTION COST	**$12,940,000**
Annual Operations and Maintenance Costs				
Inspections and Reporting (Years 1 through 5)	EA	20	$5,000	$100,000
Inspection and Reporting (Years 6 through 10)	EA	10	$5,000	$50,000
Inspection and Reporting (Years 11 through 30)	EA	20	$5,000	$100,000
Cap Maintenance	YR	30	$2,500	$75,000
			TOTAL ANNUAL O & M COST	**$325,000**
			PRESENT WORTH OM&M COSTS (5% DISCOUNT RATE)	**$170,000**
			TOTAL CAPITAL AND OM&M COSTS	**$13,110,000**

Notes:
LS - lump sum
CY - cubic yard
SY - square yard
LF - linear feet
EA - each
YR - year

TABLE 1

COST PROJECTION
ALTERNATIVE 4 - PARTIAL EXCAVATION/DISPOSAL AND CAPPING/ VEGETATIVE COVER
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Description	*Units*	*Quantity*	*Unit Price*	*Total*
Capital Construction Costs				
Predesign Investigation	LS	1	$21,000.00	$21,000
Site Preparation				
Well Abandonment/Modifications	Each	4	$750.00	$3,000
Clearing and Grubbing	Acre	13	$500.00	$6,500
Rough Grading and Shaping	CY	11,500	$6.25	$71,875
AST Tank Farm Demolition				
AST Cleaning & Removal & Demolition of Structures	LS	1	$27,000.00	$27,000
T & D of Demolition Debris (120 CY Concrete)	CY	120	$36.00	$4,320
Diesel Tank Farm Demolition				
AST Cleaning & Removal	EA	1	$21,200.00	$21,200
T & D of Demolition Debris (120 CY concrete)	CY	120	$36.00	$4,320
Building P Demolition				
Remove Fan and Ductwork East of Building P	LS	1	$3,100.00	$3,100
Remove Fan Stack West of Building P Annex	LS	1	$2,900.00	$2,900
Remove Building P Annex	LS	1	$8,100.00	$8,100
Building V Pavement				
Concrete with reinforcement (6 in.)	SY	450	$36.00	$16,200
Base course placement (6 in. rock)	SY	450	$4.70	$2,115
Subgrade preparation	CY	140	$12.50	$1,750
Soil Excavation/Disposal				
Soil Excavation/Staging	CY	60,000	$5.00	$300,000
Soil Characterization/Loading	CY	60,000	$3.00	$180,000
Soil Transport (>50 ppm)	Load	5,000	$200.00	$1,000,000
Soil Disposal (>50 ppm)	Ton	100,000	$70.00	$7,000,000
Confirmatory Sampling	Each	100	$70.00	$7,000
Restoration				
Granular Backfill	Ton	2,000	$9.75	$19,500
Topsoil (4")	CY	2,000	$29.00	$203,000
Seeding/Fertilizing/Mulching	Acre	13	$3,200.00	$41,600
Vegetative Cover Construction (9.3 acres)				
Topsoil (4")	CY	5,000	$30.00	$150,000
Seeding/Fertilizing/Mulching	Acre	9	$3,300.00	$30,690
Install Additional Groundwater Monitoring Wells	EA	7	$1,000.00	$7,000
Compacted Soil Cap (3.2 acres)				
Rework and compact subgrade (top 6 ")	CY	2,600	$1.05	$2,730
Compacted soil layer (6" use onsite soil)	CY	2,600	$15.00	$39,000
Topsoil (4")	CY	2,000	$30.00	$60,000
Seeding/Fertilizing/Mulching	Acre	4	$3,300.00	$12,210
Asphalt Roads and Driveways - Building R Complex				
Asphalt placement (4 in. binder + 3 in. surface)	SY	2,100	$17.50	$36,750
Base course placement with fabric (6 in. rock)	SY	2,100	$8.50	$17,850

"Wanner, Steve"
<swanner@craworld.com>
09/20/2005 12:34 PM

To Anton Martig/R5/USEPA/US@EPA
cc
bcc

Subject RE: 013307: Meeting Confirmation

Thank you Tony that should work fine.

Steve

STEVEN WANNER
CONESTOGA-ROVERS & ASSOCIATES
1811 Executive Drive, Suite O
Indianapolis, Indiana 46241
Tel: (317) 381-0677 Fax: (317) 381-0670
swanner@CRAWorld.com
web: http:\\www.CRAWorld.com

Equal Employment Opportunity Employer

-----Original Message-----
From: Martig.Anton@epamail.epa.gov [mailto:Martig.Anton@epamail.epa.gov]
Sent: Tuesday, September 20, 2005 12:28 PM
To: Wanner, Steve
Subject: Re: 013307: Meeting Confirmation

The meeting is in conference room 809 on the 8th floor at 10:30. Its about 9 feet x 12 feet. Larger rooms were taken.

"Wanner, Steve"
<swanner@craworl
d.com>

09/20/2005 11:16
AM

To
Anton Martig/R5/USEPA/US@EPA
cc
Carey French
<French_Carey@cat.com>,
Long_Suzette_M@cat.com,
keeling_jason_e@cat.com

Subject
013307: Meeting Confirmation

Hello Tony:

Just wanted to re-confirm the meeting time/attendees listed below. We will be bringing along a brief PowerPoint presentation to facilitate the discussion. I have a projector; we just need enough room to set it up.

We look forward to our discussion tomorrow.

Regards,

Steve

STEVEN WANNER
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Indianapolis, Indiana 46241
Tel: (317) 381-0677 Fax: (317) 381-0670
swanner@CRAWorld.com
web: http:\\www.CRAWorld.com

From: Wanner, Steve
Sent: Monday, September 12, 2005 12:05 PM
To: 'Anton Martig (martig.anton@epa.gov)'
Subject: 013307: Meeting Confirmation

Per our discussion last week, the purpose of this e-mail is to confirm our meeting on Wednesday, September 21st at 10:30 am in your office to discuss the Caterpillar Mapleton project. In addition to myself, there are three attendees from Caterpillar expected:

Jason Keeling, Utilities & Environment Superintendent, Caterpillar Mapleton Plant
Carey French, Plant Engineering, Caterpillar Mapleton Plant
Suzette Long, Attorney, Caterpillar Legal Services Division

There are a couple of new faces involved on this project since our previous meeting; Jason Keeling replaces Joe Crocker and Suzette Long replaces Gayle Hoopes.

We will provide an update of work completed since RI/FS submittal. We would like to discuss options for moving ahead given the fact that future property use plans have changed since the submittal of the RI/FS.

Thanks,

Steve

STEVEN WANNER
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1811 Executive Drive, Suite O
Indianapolis, Indiana 46241
Tel: (317) 381-0677 Fax: (317) 381-0670
swanner@CRAWorld.com
web: http:\\www.CRAWorld.com

Equal Employment Opportunity Employer

U.S. EPA, Region 5
Waste, Pesticides & Toxics Division
77 West Jackson Blvd. (DT-8J)
Chicago, IL 60604

Subject:	U.S. EPA Comments on Remedial Investigation/Feasibility Study Caterpillar Inc., Mapleton, IL
From:	Tony Martig, US EPA, Region 5
To:	Bruce Clegg, CRA
Date:	December 12, 2001

The following are U.S. EPA comments on the review of *Remedial Investigation/Feasibility Study, Caterpillar Inc., Mapleton, Illinois.* The comments should be considered as preliminary comments. However, the comments are expected to be addressed by Caterpillar before any additional review or action is taken by U.S. EPA.

If you have any questions on the comments below, and/or when you are prepared to discuss them, please contact me at the above address, (312) 353-2291, or martig.anton@epa.gov.

COMMENTS

1. Section 4.4 states that the groundwater samples were all non-detects. However, the detection limits reported in Appendix G are 1.0 ug/L. The non-detects do not necessarily indicate the absence of risk. The potential for human exposure to groundwater should therefore be included in the risk assessment. The groundwater results, with detection limits, should be included in a table in Section 4 similar to the tables that present the soil analytical results.

2. According to p. 27-28 of the report, "all analytical soil data collected from the study area for both the Caterpillar and the CRA Site investigations has been used in the RA to estimate Risks and hazards to potential human receptors." However, Table 2.1 in Appendix H only includes the CRA data. Why was the Caterpillar data included for "soil" (Table 2.3), but not "surface soil" (Table 2.1)?

3. "Surface soil" and "Total soil" were assessed, but not "subsurface soil" by itself. The construction worker scenario could involve contact with subsurface soil. The text should explain why the soil data were grouped in this way and the expected affect on the results of the analysis.

4. On page 31-32, the report states that because PCBs have a tendency to sorb strongly to organic matter, the groundwater pathway is incomplete. The report should include a citation for this statement.

5. On page 40, the reference to Tables 5.1 and 5.2 should state that they are in Appendix H.

6. On page 28, the report states that the concentrations of all Aroclors were summed to produce a total PCB concentration. However, rather than using half detection limits for non-detects, non-detects were omitted.

7. On page 36, the report states that the trespasser body weight is 45 kg, referencing Table 7-5 of the Exposure Factors Handbook (EPA, 1997). This number is said to represent the mean body weight for males age 8-17. However, it is Table 7-6 and Table 7-7 that contain these data for boys and girls, respectively. The mean values for boys and girls ages 8-17 are 46.7 and 44.7 kg, respectively. Was the mean body weight of boys and girls used?

8. The 95% UCL of the mean is typically used for both reasonable maximum exposure (RME) and central tendency (CT) assessments. However, on page 32, the report states that the 95% UCL of the mean was used as the RME EPC, but the unadjusted mean was used for the CT EPC. This could result in an underestimate of the CT exposure value.

9. On page 32 (and in the corresponding tables in Appendix H), the report references the "Shapiro Wilks" test for normality. According to the reviewer's reference, the name is actually Shapiro-Wilk. (ref. Gilbert, R.O., 1987, *Statistical Methods for Environmental Pollution Monitoring*, New York: Van Nostrand Reinhold.) The calculations for the Shapiro-Wilk test should be included in an appendix.

Caterpillar Notes

- upper layers of soil were removed down to a solid base (bldg b)
- clay fill was imported and compacted as engineered fill
- engineered fill is as much as 10 feet thick in some locations
- edges of the engineered fill were tapered to match the surrounding grade
- subsurface "clay-core dike" was constructed around Building B to provide subsurface groundwater seepage control
- TP&W rail easement was relocated several hundred feet to the south of its original position
- relocated rail bed was raised on compacted engineered clay fill by as much as 10 feet above the grade that existed at that time
- Swale Area formerly was a low-lying area formed by the clay sidewalls of the TP&W rail bed to the south and east, the engineered fill to the north, and the clay road embankment leading to the pump houses on the west (near Buildings N and RR)
- Swale Area is underlain by a native clay layer

Groundwater and Wells

- Three groundwater monitoring wells (MW-99A, MW-99B, and MW-99C) were installed within the Swale Area on November 15 and 16, 1999, at the locations shown on Figure 3.4
- These monitoring wells were installed at the downgradient edge of the Swale Area to determine if dissolved PCBs were present in the groundwater within, and potentially migrating from, the Swale Area
- summary of the calculated groundwater elevations is provided in Table 3.3
- Figures 4.3 and 4.4 illustrate the foundry sand was placed in areas surrounded with clay
- foundry sand is underlain by clay throughout the area
- Ten soil borings contacted the underlying clay unit, and PCBs were not detected in nine of the ten soil samples collected from clay
- PCBs at a concentration of 0.062 mg/kg in one sample collected from the 8- to 10-foot depth
- Groundwater flow beneath the Swale Area was evaluated by measuring groundwater elevation in the three new monitoring wells Area (MW-99A, MW-99B, and MW-99C), two existing monitoring wells (G-101S and G-102S), and one existing piezometer (P-109S)
- Monitoring wells MW-99A, MW-99B, and MW-99C were screened at depths ranging from approximately 17 to 17.5 feet
- Monitoring wells G-101S and G-102S are approximately 18 feet and 15 feet deep, respectively
- Piezometer P-109S is approximately 17 feet deep. All are constructed with 10 feet of slotted well screen.
- screened interval for MW-99B penetrates 4 feet of the foundry sand fill and 6 feet of the underlying clay
- monitoring wells MW-99A and MW-99C penetrate the native upper sand unit, which appear to be acting as distinct hydrostratigraphic units
- presence of a groundwater high (mound) within the Swale Area conclusion is supported by the fact that the groundwater elevations are the highest at monitoring wells MW-99A and MW-99C suggesting a radial flow outward from the Swale Area

- radial groundwater flow pattern suggests that groundwater flow in the Swale Area is driven by precipitation rather than local or regional gradient effects
- Permeability clay unit indicates a vertical hydraulic conductivity of 4.2 x 10-8 cm/sec

Remedial Alternative 2

- capping over a limited area, grading and vegetative cover improvements, deed restrictions, access controls (fencing), inspection and maintenance
- compacted soil cap would be constructed in accordance with 40 CFR Part 761 in the northern portion of the WSA
- The compacted soil cap would include reworking and compaction of the upper 4 to 6 inches of the existing soil cover and placement of 6 inches of compacted clean fill from an existing on-site soil stockpile
- This would be covered with 4 inches of soil suitable for sustaining a vegetative cover
- The access roads and drives in the vicinity of Building R would be upgraded to asphalt or concrete to permit vehicular access and act as a cap – thickness of cap?,
- existing soil would be regraded and reseeded to establish a robust vegetative cover over the ESA and to promote surface drainage
- layer of imported topsoil would be placed, as necessary, to promote the growth of a grass vegetative cover to stabilize the soil. Thickness? 4-6" road - e-w → 4-6"
- landfill access road in the eastern portion of the ESA would be upgraded with asphalt or concrete to permit vehicular access to the permitted foundry sand landfill to the south – thickness?
- Fencing and signage would be installed around the ESA to reduce potential industrial worker and trespasser access to the area.
- Institutional controls in the form of deed restrictions would be used to identify areas where remedial actions were implemented, specify ongoing maintenance of these areas, and identify low occupancy areas (ESA)
- deed restrictions would also specify industrial/commercial land use and a groundwater use restriction.
- A soil management plan would be developed to ensure proper handling of any soil removed from the area in the future
- health and safety plan would be prepared and implemented for work required in these areas to minimize short-term construction worker exposure to PCBs.
- operations and maintenance (O&M) plan would be developed to specify the tasks to be performed to ensure the fence, cap, and vegetative cover areas remain in good repair
- Figure 10.1 for location of fence, etc.

Is there a certification signed by owner, with the following:
identifying where all sampling plans, sample collection procedures, sample preparation procedures, extraction procedures, analysis procedures, are on file

Notification
Was the letter/notification also sent to State and Local environmental agencies

Established not in flood plain

Schedule, disposal, technical approach

Contingencies for higher level waste

Written certification

Pad – concrete sample in accordance with subpart o

Submit self-implementing

Low occupancy only – satisfies this not high occupancy

Restrict to low occupancy with deed notice that includes a map showing extent of PCB contamination -- suggest wording

No verification sampling points required if leave in place

Expectation of swale ri/fs or application and pad sample results

1. After reviewing the analytical data, I can find no borehole ID number (B-?) or location information (map) for samples taken on March 1 and 2, 2005. The specific sample numbers range from S-030105-JH-001 through S-030105-JH-032 and S-030205-JH-033 through S-030205-JH-052.

2. The analytical data indicates that there are PCBs greater than 50 ppm at the site. The work plan indicates that there are no PCBs greater than 25 ppm on the site and that there is no remedial action necessary to meet the low occupancy standards of the PCB regulations. The greatest concentration (1200 ppm) is found in analytical sample S-030205-JH-040. This sample is in the group referenced in question one. There is one reference to this sample on page 14 in the last bullet item under Section 4.2. It is identified as B-56 which is not shown on Figure 4.1.

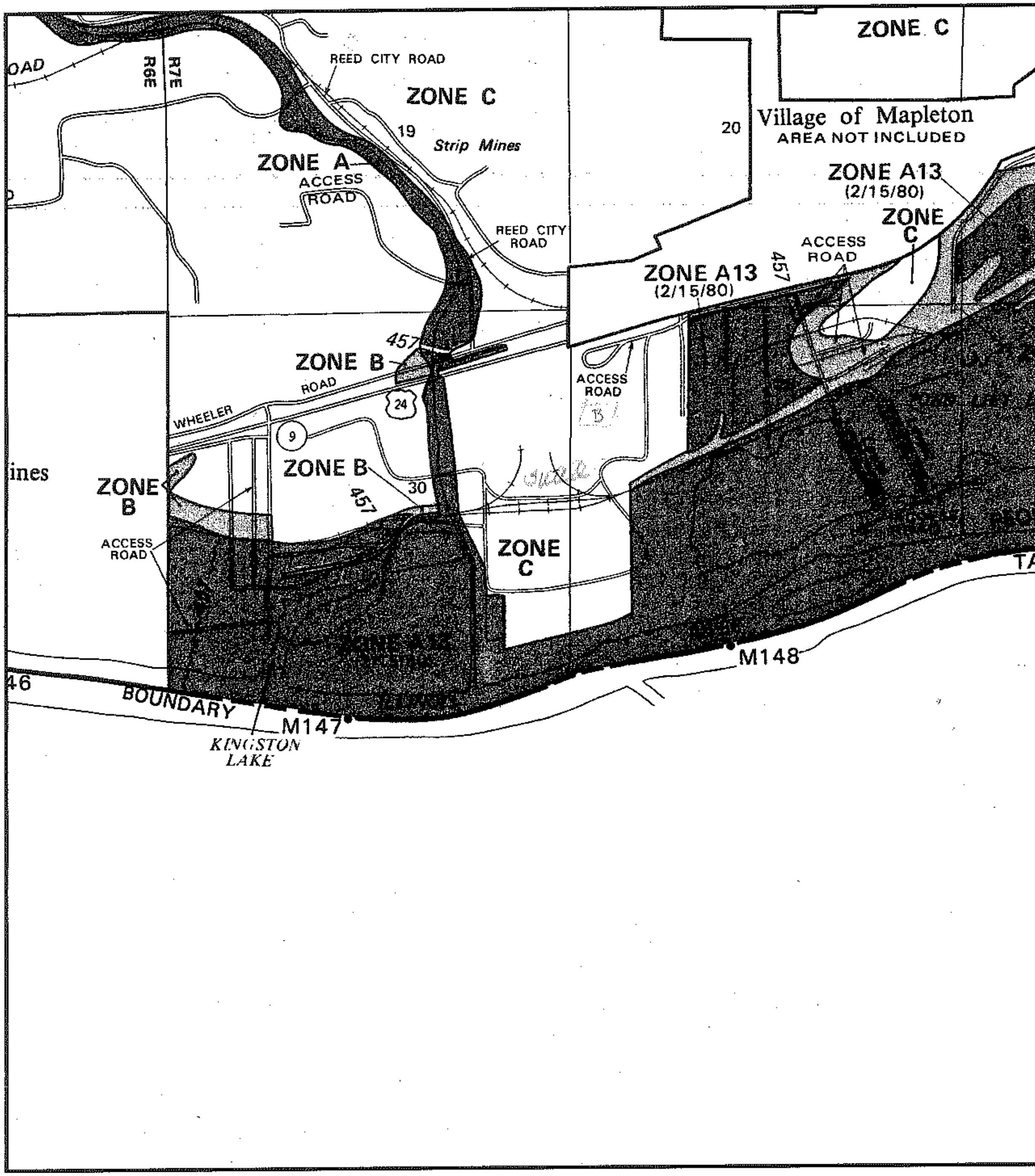
3. The PCB units on Figure 4.1 are identified at ug/kg when the units are mg/kg.

4. Has there been any previous removal of PCB contaminated material at the site? The RCRA drum area has elevated levels of PCBs and it seems that this might have been remediated. If so, were there any confirmation samples taken and what are the results?

5. Has the interior of Building B been sampled for PCBs?

6. Is the site in the 100 year flood plain of the river and/or creek?

7. How deep are the dikes surrounding Building B?



APPROXIMATE SCALE

2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

COUNTY OF
PEORIA,
ILLINOIS
(UNINCORPORATED AREAS)

PANEL 200 OF 200

COMMUNITY-PANEL NUMBER
170533 0200 B

MAP REVISED:
JUNE 1, 1983

Federal Emergency Management Agency

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SWALE AREA

CATERPILLAR INC.
MAPLETON, ILLINOIS

VOLUME I – TEXT, FIGURES & TABLES

JUNE 3, 2010
REF. NO. 013307 (4)

Prepared by:
Conestoga-Rovers & Associates

6520 Corporate Drive
Indianapolis, IN 46278

Office: (317) 291-7007
Fax: (317) 328-2666

web: http:\\www.CRAworld.com

EXECUTIVE SUMMARY

Caterpillar Inc. (Caterpillar) operates a gray iron foundry at its Mapleton, Illinois facility that manufactures engine blocks, cylinder heads, liners, and camshafts. In 1998, Caterpillar initiated a soil investigation in a small portion of the plant property where drums containing hazardous wastes were formerly stored in a drum storage area permitted under the Resource Conservation and Recovery Act (RCRA). During the investigation, polychlorinated biphenyls (PCBs) were detected in soil samples. The subsequent soil investigations completed by Caterpillar identified the presence of PCBs in soil within and adjacent to the former RCRA Drum Storage Area. A more comprehensive soil and groundwater investigation was then initiated within and proximal to the area where PCB-containing soil was previously identified.

The area that is the primary focus of this report is the Swale Area. The Swale Area is located on the northern 200 acres of the Caterpillar property and is bounded to the south and east by the Toledo, Peoria, and Western Railroad (TP&W) easement, to the west by the road to the pump houses, and to the north by Building B. The Swale Area is divided into two sections, the West Swale Area (WSA) and the East Swale Area (ESA). The Swale Area was originally a low-lying area on the plant property covering approximately 13 acres formed by the construction of rail easements, access roads, and structures. Subsequently, used foundry sand was used to fill this low lying area.

Investigative activities completed to date have been successful in delineating the nature and extent of PCB impacts in the soils of the Swale Area. In addition to successfully delineating PCB impacts, a thorough understanding of the geology and hydrogeology of the plant property was obtained during the investigations documented by this report.

A Human Health Risk Assessment (HHRA) was completed for the two sections of the Swale Area (ESA and WSA). The HHRA was prepared in accordance with the National Contingency Plan and applicable U.S. Environmental Protection Agency (U.S. EPA) guidance. The HHRA included PCBs as the Chemicals of Potential Concern and concluded that the total estimated lifetime cancer risks for all reasonably expected potentially exposed populations fall within or below the U.S. EPA's acceptable target cancer risk range and that the estimated hazard indices are below the level of concern. Therefore, very costly remedies that permanently remove PCBs from the Swale Area are not warranted. However, PCBs are present in soil at concentrations above the objectives promulgated at 40 Code of Federal Regulations (CFR) Part 761.61. Therefore, actions to mitigate potential human exposure to the PCB-containing soil and ensure proper future management of PCB-containing soil are warranted.

The ESA meets the criteria for a low occupancy area as described in 40 CFR Part 761.3. The WSA is considered a high occupancy area. The PCB concentrations in soil in the ESA and WSA are above the cleanup level for bulk PCB remediation waste for low and high occupancy areas, respectively.

An Ecological Risk Evaluation of the PCBs in soils within the Swale Area was performed. This screening level evaluation indicates that no significant ecological risk is present from the Swale Area. Exposure pathways from the PCBs to ecological receptors are functionally incomplete.

Based upon the results of the soil investigations, the Human Health Risk Assessment, and the Ecological Risk Evaluation, the following Remedial Action Objectives were developed for the Swale Area.

EAST SWALE AREA (ESA)

The ESA will be maintained as a low occupancy area. The specific Remedial Action Objectives include:

1. minimize direct contact to PCBs in soil at concentrations above 25 milligrams per kilogram (mg/kg)
2. minimize inhalation of soil containing PCBs at concentrations above 25 mg/kg
3. ensure occupancy levels remain at or below the low occupancy level specified at 40 CFR Part 761
4. reduce surface water infiltration into the existing soils through grading and drainage controls of the surface cover

WEST SWALE AREA (WSA)

The WSA is a high occupancy area. The specific Remedial Action Objectives include:

1. minimize direct contact to PCBs in soil at concentrations above 10 mg/kg
2. minimize inhalation of soil containing PCBs at concentrations above 10 mg/kg
3. control worker access to the open land found east and immediately south of Building R
4. reduce surface water infiltration into existing soils through grading and drainage controls of the surface cover

PCBs were not detected in groundwater in the Swale Area. Therefore, Remedial Action Objectives are not necessary for the groundwater media.

A number of remedial technologies applicable to PCB-containing soil in both the ESA and the WSA were identified and screened. The following Remedial Action Alternatives were developed to satisfy the Remedial Action Objectives for PCB-containing soil using the following retained remedial technologies.

- Alternative 1 - No Action;
- Alternative 2 - Partial Capping, Grading Improvements, Vegetative Cover, Deed Restrictions, Access Controls, and Inspection and Maintenance; and
- Alternative 3 - Capping, Deed Restrictions, Access Controls, and Inspection and Maintenance.

Each of the above-noted alternatives, except no action, would include upgrading and maintaining the fencing surrounding the Swale Area (ESA and WSA). Deed restrictions would be established to ensure the Swale Area remains in industrial use. Further deed restrictions and access controls would be established to ensure the ESA remains a low occupancy area as defined by 40 CFR Part 761.61.

Alternative 1 is the lowest cost alternative but does not meet the Remedial Action Objectives, does not comply with Applicable or Relevant and Appropriate Requirements (ARARs), and would not be protective of human health and the environment.

Alternatives 2 and 3 both rated favorably in the following criteria:

1. overall protection of human health and the environment
2. compliance with ARARs
3. long-term effectiveness and permanence
4. reduction in the toxicity, mobility, or volume of material
5. short-term effectiveness
6. implementability
7. cost

Alternatives 2 and 3 comply with ARARs and provide nearly equivalent levels of protection to human health and the environment. However, Alternative 2 accomplishes this protectiveness at the lowest cost and is the preferred alternative.

A summary of the estimated costs for the Remedial Action Alternatives, in reverse order (from most expensive to least expensive), is provided below:

Remedial Alternative Description		*Present Worth Cost*
Alternative 3:	Capping, Deed Restrictions, Access Controls, and Inspection and Maintenance	$1,430,000
Alternative 2:	Partial Capping, Grading Improvements, Vegetative Cover, Deed Restrictions, Access Controls, and Inspection and Maintenance	$1,270,000
Alternative 1:	No Action	$0

The Remedial Investigation and Feasibility Study was completed, and this document was prepared for the purposes of obtaining approval from the U.S. EPA Regional Administrator for a risk-based closure at the Swale Area pursuant to 40 CFR Part 761.61(c).

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(Following Report)

<u>LIST OF FIGURES (CONT'D)</u>
(Following Report)

LIST OF TABLES
(Following Report)

LIST OF APPENDICES

LIST OF COMMONLY USED ACRONYMS AND SHORT FORMS

AMSL	above mean sea level
ARAR	applicable or relevant and appropriate requirements
AST	aboveground storage tanks
AT	averaging time
bgs	below ground surface
BCF	Bioconcentration Factor
°C	Degrees Centigrade
CDI	Chronic Daily Intake
CERCLA	Comprehensive Response Compensation and Liability Act
CILCO	Central Illinois Light Company
CFR	Code of Federal Regulations
cm/s	centimeters per second
COPC	compound of potential concern
CRA	Conestoga-Rovers & Associates
CSF	Cancer Slope Factor
CT	Central Tendency
°F	Degrees Fahrenheit
Daily	Daily Analytical Laboratories of Peoria, Illinois
ED	exposure duration
EPC	exposure point concentration
ESA	East Swale Area
Hanson	Walter E. Hanson Company
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
Koc	Octonol-Carbon Coefficient
K_{ow}	n-octanol-water
LMS	linearized multistage
LOAEL	Lowest-Observed Adverse Effect Level
MLE	maximum likelihood estimate
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter

LIST OF COMMONLY USED ACRONYMS AND SHORT FORMS (CONT'D)

mg/L	milligrams per liter
mmHg	millimeters of mercury
NCP	National Contingency Plan
NOAEL	No-Observed Adverse Effect Level
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
PCBs	Polychlorinated Biphenyls
PEF	particulate emission factor
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Ftudy
RME	Reasonable Maximum Exposure
RMT	Residuals Management Technology
SARA	Superfund Amendment and Reauthorization Act
SRP	Site Remediation Program
TP&W	Toledo, Peoria, and Western Railroad
TSCA	Toxic Substances Control Act
UCL	upper concentration limit
URF	unit risk factor
U.S. EPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
WSA	West Swale Area

1.0 INTRODUCTION

1.1 PLANT LOCATION

This Remedial Investigation/Feasibility Study (RI/FS) report summarizes the results of investigative activities completed at the Caterpillar Inc., Mapleton, Illinois plant property. Caterpillar operates a gray iron foundry on the northern 200 acres of property. The plant property consists of approximately 350 acres and is located adjacent to the Illinois River immediately south of the Village of Mapleton, Illinois, and approximately 4 miles west of the City of Pekin, in Hollis Township, Peoria County, Illinois. The plant property is located in Sections 29 and 30, Township 7 North, Range 5 West of the Third Principal Meridian in Peoria County, Illinois, between U.S. Highway 24/Illinois Highway 9 and the Illinois River (Figure 1.1). The plant property lies in the valley of the Illinois River at River Mile 147, approximately 11 river miles downstream of the Peoria Lock and Dam. The plant property and features are shown on Figure 1.2

The Swale Area, which is the focus of this report, is an approximately 13 acre parcel located south and southwest of former Building B, as shown on Figure 1.3. The Swale Area is a formerly-low lying area formed by the construction of rail easements, access roads, and structures that was subsequently filled with used foundry sand.

1.2 BACKGROUND

In 1998, Caterpillar initiated a soil investigation in a small portion of the plant property where drums containing hazardous wastes were formerly stored in a Drum Storage Area permitted under the Resource Conservation and Recovery Act (RCRA). During the course of this investigation, polychlorinated biphenyls (PCBs) were detected in soil samples although these compounds were not among the chemicals stored in the former Drum Storage Area. Subsequent soil investigations completed by Caterpillar identified the presence of PCBs in soil within and adjacent to the former RCRA Drum Storage Area.

Caterpillar subsequently retained Conestoga-Rovers & Associates (CRA) to implement a soil and groundwater investigation within and proximal to the area where PCB-containing soil was identified during Caterpillar's investigations. CRA implemented this investigation, and this report provides a comprehensive summary of the related plant property investigations completed to date. These investigations focused on the distribution of PCBs in soils and/or groundwater in the Swale Area. In addition to completing a soil and groundwater investigation in the Swale Area, background information concerning the geology and hydrogeology of the plant property was compiled from the public literature and previous work at the plant property.

Investigative activities completed to date were successful in delineating the nature and extent of PCB impacts to soils and groundwater in the Swale Area. A consistent and comprehensive understanding of the geology and hydrogeology of the plant property has been obtained through these and previous investigations. PCBs were found to occur in soil over a limited area of the plant property that was filled historically with foundry sand (Swale Area). Although PCBs have been detected in foundry sand fill over a limited area of the plant property, PCBs were not detected above concentrations of concern in later foundry sand fill deposits. No impact to groundwater resulting from the placement of this material has been observed at the plant property.

1.3 PURPOSE

The purpose of this report is to provide the information, as summarized at 40 Code of Federal Regulations (CFR) Part 761.61(c), to the U.S. Environmental Protection Agency (U.S. EPA) Regional Administrator and to seek approval from the Regional Administrator for a risk-based closure at the Swale Area.

During the meeting with the U.S. EPA on May 31, 2000, Caterpillar presented the available findings and made a request to pursue risk-based closure of the Swale Area consistent with the regulations codified at 40 CFR Part 761, which was published in the Federal Register on June 29, 1998. The U.S. EPA agreed to consider the risk-based approach and stated that such a closure may proceed under the auspices of Illinois' Site Remediation Program (SRP) as codified at Title 35 Illinois Administrative Code (IAC) Part 740. These findings also were presented to the Illinois Environmental Protection Agency (IEPA) during a subsequent meeting convened on June 29, 2000. This document represents the next step in the pursuit of a risk-based closure.

Caterpillar submitted an RI/FS report to the U.S. EPA in May 2001 that included a summary of the plant property environmental setting and analytical data, and evaluated the human health risks consistent with applicable U.S. EPA guidance. Several remedial options were evaluated to address the presence of PCBs in soil at the Swale Area. In December 2001, the U.S. EPA submitted a number of preliminary comments on the RI/FS report. Subsequently, Caterpillar re-assessed its future land use plans for the Mapleton plant and, in response, completed further investigative activities in 2005. In September 2005, another meeting was held with the U.S. EPA to discuss the analytical data, risk-based closure options under the Toxic Substances Control Act (TSCA), and flexibility to alter the closure of an area should the future land use change.

This revised RI/FS report contains additional data, updated information concerning future land use assumptions, and a revised risk assessment. Therefore, this RI/FS report is intended to supplant the May 2001 submittal for the Swale Area.

1.4 REPORT ORGANIZATION

This report has been organized into 12 sections as summarized below.

- Section 1.0 provides the background, purpose, and organization of this report.
- Section 2.0 presents an overview of the plant property including the definition, location and description, geologic and hydrogeologic setting, and history.
- Section 3.0 provides an overview of investigations completed.
- Section 4.0 summarizes the data compiled during investigative activities.
- Section 5.0 provides a summary of the Human Health Risk Assessment.
- Section 6.0 provides an ecological risk evaluation.
- Section 7.0 discusses PCB fate and transport mechanisms.
- Section 8.0 identifies remedial action goals and objectives.
- Section 9.0 identifies, summarizes, and screens remedial technologies.
- Section 10.0 identifies and evaluates remedial alternatives.
- Section 11.0 provides a comparative analysis of remedial alternatives.
- Section 12.0 provides a summary and conclusions.

2.0 PLANT PROPERTY OVERVIEW

2.1 PLANT PROPERTY DESCRIPTION AND FEATURES

2.1.1 HISTORY AND DESCRIPTION

Caterpillar operates a gray iron foundry located in Mapleton, Illinois. The foundry manufactures engine blocks, cylinder heads, liners, and crankshafts used in Caterpillar equipment and for sale to other companies. The Mapleton plant is a major metal recycler. Caterpillar acquired and began to develop the property in the middle 1960s. Building B, the first foundry building constructed on the property, and a number of adjacent support buildings were constructed in the late 1960s. The first iron was poured in Building B in 1967. Building D, the second foundry building, and associated support buildings were constructed in the middle 1970s. The first iron was poured in Building D in 1978. Currently, Caterpillar's foundry operations and associated administrative offices are housed in Building D. Operations in Building B were shut down in the late 1980s due to excess capacity and process modernization, and Building B was subsequently demolished in 2008/2009. Figure 1.2 provides a map depicting major features at the plant property.

Building B is located on the eastern portion of the plant property, east of Little LaMarsh Creek. A paved road connects the active western portion of the plant with the eastern portion. Building B formerly occupied an area of approximately 1,000,000 square feet. Buildings A and M were connected to the north side of Building B and formerly served as plant administrative offices and a pattern shop. East of Building B is a 12-acre asphalt parking lot. West of Building B is undeveloped plant property. A rail easement owned by the Toledo, Peoria, and Western Railroad (TP&W) lies several hundred feet south of Building B. TP&W's rail easement runs east-west and then curves towards the northeast. TP&W's rail line was originally located north of its present location but was relocated south to facilitate construction of Building B. Directly south of Building B, between Building B and the TP&W railroad line, are Building V, Building P, Building Q, and a substation owned by Central Illinois Light Company (CILCO). Building V is currently used for material storage, and Building P is unused and currently vacant. Building Q is an unused electrical switchgear facility. Southwest of Building B and west of Building V is Building R, which provides the plant's compressed air, potable water, and sanitary waste treatment. Farther to the west of Building B are Building RR, the industrial wastewater treatment plant, and the former Building N, an unused heating complex that was demolished in 2008/2009.

Caterpillar operates an 80-acre foundry sand landfill on land located south of the TP&W rail easement, between the rail easement and the Illinois River. The foundry sand landfill (hereinafter designated the "817 landfill") is operated under Title 35 IAC Part 817 rules and does not accept any material from off-site sources.

2.1.2 SWALE AREA DESCRIPTION

The Swale Area comprises an area of approximately 13 acres and is bounded to the south and east by the TP&W rail easement, to the west by the road to the pump houses, and to the north by Building B (see Figure 1.3).

Extensive geotechnical investigations of the plant property, undertaken in 1964 and 1965, concluded that the native soils did not have the physical capacity to support a large manufacturing building. Therefore, the upper layers of soil were removed down to a solid base, and clay fill was imported and compacted as engineered fill. The engineered fill is as much as 10 feet thick in some locations. The edges of the engineered fill were tapered to match the surrounding grade. A subsurface "clay-core dike" was constructed around Building B to provide subsurface groundwater seepage control. The TP&W rail easement was relocated several hundred feet to the south of its original position. The relocated rail bed was raised on compacted engineered clay fill by as much as 10 feet above the grade that existed at that time.

The Swale Area formerly was a low-lying area formed by the clay sidewalls of the TP&W rail bed to the south and east, the engineered fill to the north, and the clay road embankment leading to the pump houses on the west (near Buildings N and RR). The Swale Area is underlain by a native clay layer. Rail spurs trending north-south from the TP&W rail easement to Building B were built on engineered fill and divide the Swale Area. The Swale Area was completely formed when industrial production began at Building B in 1967. The Swale Area was filled in the past with used foundry sand in order to bring it up to the grade of the features that surrounded the Swale Area (i.e., the engineered fill areas to the north, south, and west). Based upon a review of aerial photographs, it is believed that filling of the Swale Area occurred primarily in the early 1970s. The 817 landfill was placed in operation in 1977, and after that time, used foundry sand was deposited exclusively in the 817 landfill.

2.2 PHYSICAL SETTING

2.2.1 LAND USE

Land use in the vicinity of the plant property is a mixture of industrial, agricultural, and open space. Land use south of U.S. Highway 24/Illinois Highway 9, a four lane divided highway, is primarily industrial. The plant property abuts industrial property to the east, and this industrial land use extends approximately 2 miles to the east, upstream along the Illinois River. North of Highway 24/9, land use is primarily sparse residential, agricultural, and open space. Much of the land immediately north of the plant property is wooded, especially in the deeply incised drainage valleys. The Village of Mapleton, Illinois (population approximately 200) lies across Highways 24/9 from the eastern portion of the plant property.

South of the Illinois River, land use is primarily agricultural, with widely scattered residences. There are no major population centers within a 3-mile radius of the plant property. Southeast of the plant property and on the opposite side of the Illinois River, lies Powerton Lake, a large cooling water reservoir serving the Powerton electrical generating plant.

2.2.2 TOPOGRAPHY AND DRAINAGE

Topography in the vicinity of the plant property ranges from nearly flat to steeply sloping. Between the north bank of the Illinois River and Highway 24/9, surface topography is relatively flat to gently sloping towards the Illinois River. The normal pool elevation of the Illinois River is approximately 431 to 435 feet above average mean sea level (AMSL). At the shore of the Illinois River, the elevation is approximately 435 feet AMSL. Surface elevations inland of the Illinois River range from approximately 440 feet to 460 feet AMSL. To the north of Highway 24/9, the elevation increases relatively steeply, forming bluffs that rise to an elevation of over 600 feet AMSL (see Figure 1.1). These bluffs are incised by deep, steeply sloped drainage valleys associated with tributaries that convey water towards the Illinois River. These valleys are generally wooded.

The most significant of the drainage tributaries is Little LaMarsh Creek, which drains most of the land north of the plant property. Little LaMarsh Creek flows in a north to south direction through the center of the plant property and discharges into the Illinois River. The central portion of the plant property is unpaved, and surface water runoff is directed towards Little LaMarsh Creek. Areas surrounding the plant structures are covered with impervious surfaces (concrete, asphalt, or compacted gravel). Surface water runoff from these areas and the roofs is directed to subsurface storm sewers and discharges to the Illinois River.

South of the TP&W rail easement, surface water is routed by overland flow, ditches, and channels towards the Illinois River.

2.2.3 CLIMATE

The climate in central Illinois is continental with a wide range of temperature extremes. Based on recorded weather data for Peoria from 1961 to 1990, the mean January temperature is 21.7 degrees Fahrenheit (°F), and the mean July temperature is 75.4°F. The mean annual temperature is 50.5°F. The mean annual precipitation is 36.2 inches. February is normally the driest month with 1.4 inches of precipitation, and July is usually the wettest month with 4.2 inches of precipitation.

2.2.4 POPULATION

Peoria County is located in the north-central portion of Illinois and has a land area of approximately 629 square miles. The estimated population of Peoria County is approximately 183,400, according to the County's web site. The major population center is located in and around the City of Peoria. The average number of persons per square mile in Peoria County was approximately 292 in 1999. The population of Mapleton, the village located closest to the Site, is approximately 200. The Village of Mapleton is approximately 0.9 square miles in area. The City of Pekin, located in Tazewell County approximately 4 miles southeast, has a population of approximately 32,000.

2.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.3.1 REGIONAL GEOLOGY

The plant property is located on the Galesburg Ridge Plain area of the Till Plains Section in the Central Lowland Province (Figure 2.1). Regionally, this area has prominent glacial topography characteristics of the Illinoian Glaciation Stage (Figure 2.2). However, within the Illinois River Valley and in the vicinity of the plant, deposits from the Illinoian Glaciation have been eroded, and outwash deposits from the more recent Wisconsinan Glaciation and recent alluvium sediments are present.

Published literature regarding the regional stratigraphy beneath the plant property indicates that it is comprised of a layer of unconsolidated alluvium consisting of clay, silt, sand, and gravel, which overlies bedrock. The area of the plant property has been mapped as A2 and B2 for the northern half of the plant property on Plates 1 and 2 of the Berg Circular, respectively, and as AX on both Plates 1 and 2 for the southern half of the plant property (Figures 2.3A and 2.3B).[1] Areas mapped as A2 on Plate 1 are described as "Thick, permeable sand and gravel within 20 feet of land surface". Areas mapped as B2 on Plate 2 are described as "Permeable bedrock between 5 and 20 feet of surface, overlain by silty or clayey till and loess; relatively impermeable weathered zone in till". Areas mapped as AX are described as "Alluvium, a mixture of gravel, sand, silt, and clay along streams, variable in composition and thickness".

On the Stack-Unit Map of Illinois (Figure 2.4)[2] the northern half of the plant property is shown as overlying at least 20 feet of the Henry Formation, and the southern half of the plant property is shown as overlying at least 20 feet of the Cahokia Alluvium and at least 20 feet of the Henry Formation. The Henry Formation consists of glacial outwash of sand and gravel[3]. The Cahokia Alluvium includes the deposits in the floodplains and channels of present rivers and consists mainly of poorly sorted silt, clay, and silty sand, but locally contains lenses of sand and gravel[4].

Bedrock beneath the plant property is identified as Pennsylvanian-age strata of the Carbondale and Modesto Formations (Figure 2.5)[5]. The Pennsylvanian System is approximately 200 feet in thickness beneath the area (Figure 2.6)[6]. The Carbondale and Modesto Formations are comprised primarily of shale with interbedded limestone, coal and sandstone units (Figures 2.7A and 2.7B)[7].

2.3.2 REGIONAL HYDROGEOLOGY

Regionally, the alluvial sand and gravel deposits adjacent to the Illinois River are known as the Sankoty aquifer.[8] The Sankoty Aquifer has a relatively wide distribution and potentially large groundwater yields. Regional flow in the Sankoty Aquifer is towards the Illinois River. The Sankoty Aquifer is hydraulically connected to the river and contributes to its base flow.

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[1] R.C. Berg, Kempton, J.P. and Cartwright, K., Potential for Contamination of Shallow Aquifers in Illinois, Illinois Department of Energy and Natural Resources, Circular 532, 1984.

[2] R.C. Berg, Kempton, J.P., Stack-Unit Mapping of Geologic Materials in Illinois to a Depth of 15 Meters, Illinois State Geologic Survey, Circular 542.

[3] H.B. William et al., Handbook of Illinois Stratigraphy, Illinois State Geological Survey, Bulletin 95, 1975, p 164.

[4] IBID.

[5] IBID.

[6] IBID.

[7] IBID.

[8] S.L. Burch and Kelly, D.J., Peoria-Pekin Regional Groundwater Quality Assessment, Illinois Department of Energy and Natural Resources, Illinois State Water Survey Division, Research Report 124, 1993.

2.4 PLANT PROPERTY GEOLOGY AND HYDROGEOLOGY

The following provides an overview of the specific geologic and hydrogeologic conditions in the Swale Area and in the nearby plant property.

2.4.1 PLANT PROPERTY GEOLOGY

Historically, extensive geotechnical investigations of the property were undertaken to determine if the soils would support industrial development. During the period of October 1964 through February 1965, Walter E. Hanson Company (Hanson) advanced numerous geotechnical soil borings over the area formerly occupied by Building B and its surroundings. Most of the geotechnical boring locations were referenced to the plant property's horizontal grid, which is still in use. As such, the locations of these geotechnical soil borings are recoverable and are plotted on Figure 2.8. Stratigraphic logs generated during geotechnical investigations are reproduced in Appendix A. These geotechnical soil borings were advanced before development and are useful for establishing baseline conditions.

General subsurface stratigraphy identified by Hanson included clays and silts to depths ranging from 2 to 13 feet below ground surface (bgs). Underlying the clays and silts, a granular deposit consisting of sand, gravel, and some small boulders was identified. The thickness of the granular deposit was variable and extended to the top of the bedrock surface. Bedrock identified beneath the plant property consisted of brown to gray shale and fine-grained gray sandstone. Soil boring logs indicate that the unconsolidated stratigraphic units at the plant property range in thickness from approximately 20 feet at several Hanson soil borings in the northern portion of the plant property to greater than 70 feet in the southern portion of the plant property (B-311) and are bounded at their base by shale bedrock. The stratigraphic information indicates that the depth to the bedrock surface increases to the south towards the Illinois River.

Additional geological investigations were completed at the plant property by Residual Management Technology, Inc. of Madison, Wisconsin (RMT) in the early to middle-1990s, in association with Caterpillar's 817 landfill. RMT's investigations were primarily focused on the 817 landfill, which is located south of the TP&W rail easement. The stratigraphy beneath the plant property was described as consisting of valley fill and outwash deposits that overlie shale bedrock.[9] Four significant local hydrogeologic

[9] Residual Management Technology, Inc., Additional Information for Significant Modification Application, Log #1995-154, 35 IAC Part 817.309 Facility Location Demonstration, March 1997, p 8.

units were identified overlying bedrock at the plant property and included the Upper Sand Unit, Intermediate Clay Aquitard, Lower Sand Unit, and Lower Clay Aquitard. These are described below in more detail.

Upper Sand Unit

An upper sand unit is only present beneath the southeastern portion of the plant property. The upper sand unit pinches out towards the north and is not present north of the TP&W rail easement in the Swale Area. The upper sand unit is generally described as a yellowish-brown and poorly graded (Unified Soil Classification System [USCS] designation "SP"). Based on drilling logs prepared by RMT (Appendix B) the unit ranges in thickness from 4 to 15 feet.

Intermediate Clay Aquitard

The intermediate clay aquitard underlies approximately the southern two-thirds of the plant property, including the Swale Area. This unit consists of medium-dense, greenish-gray clay with some silt, with moderate to high plasticity. The unit ranges from 12 feet to 56 feet in thickness and has a reported hydraulic conductivity in the range of 10^{-7} to 10^{-9} centimeters per second (cm/s). At depth, the unit becomes gray and/or brown in color, and the silt and sand content increases. This unit extends from the south side of Building B to the Illinois River. In the central third of the plant property, the intermediate clay aquitard overlies bedrock, and in the southern third the unit overlies the lower clay unit. The intermediate clay aquitard underlies the fill in the Swale Area.

Lower Sand Unit

Information on the lower sand unit is based on drilling logs from Hanson's geotechnical investigation (Appendix A) and from several of RMT's monitoring well logs (G103, G104D, and G106D) and soil boring logs (B-311, B-313, B-317, and B-318) presented in Appendix B. The lower sand unit appears to be present only beneath the southern third of the plant property and underlies the intermediate clay aquitard and the Illinois River. The lower sand unit appears to be typical channel sand and lag sediment deposited in a fluvial environment. The unit has been described as a well to poorly graded, loose to medium dense sand with some to no gravel (SP). The lower sand unit pinches out toward the north against the shale bedrock surface and is not present beneath the Swale Area.

Lower Clay Aquitard

Information on the lower clay aquitard is based on drilling logs from the same locations as those identified for the lower sand unit. The unit has been described as a lean to silty, loose to medium stiff/stiff gray clay. The upper portion of the lower clay aquitard is believed to represent more recent deposition of fine-grained low-energy river sediments and contains organic matter, wood fragments, and shells. In some places, the lower portion of the lower clay becomes greenish gray in color and is believed to represent weathered shale bedrock, based on the amount of shale fragments present in soil samples. The lower clay unit appears to be present only in the southern third of the plant property, south of the Swale Area, and underlies the lower sand unit and overlies bedrock.

Bedrock

Stratigraphic logs from deep geotechnical and investigative soil borings indicate that the depth to bedrock beneath the plant property ranges from approximately 10 feet to greater than 70 feet at B-311. The depth to the bedrock surface increases to the south towards the Illinois River. The bedrock was described as blue/gray or brown shale with traces of sandstone. Appendix C contains a stratigraphic log from a test well drilled to a depth of 310 feet bgs. The stratigraphy for the test well indicated that the bedrock underlying the plant property is comprised primarily of shale with interbedded limestone, coal, and sandstone units. This stratigraphy is consistent with the published bedrock geologic description of the area.

Using soil borings advanced during previous investigations and the investigation described in Section 3.0, geologic cross-sections were developed. These cross-sections are provided as Figures 2.9 (north-south) and 2.10 (east-west). The north-south geologic cross-section depicts subsurface geology from a point just north of Building B through Building B to a point due south located in the center of the Illinois River. In general, unconsolidated Cahokia Alluvium overburden deposits, consisting of alternating layers of sand and clay, thicken towards the south.

2.4.2 PLANT PROPERTY HYDROGEOLOGY

In general, groundwater flow in the unconsolidated deposits beneath the plant property is to the south, towards the Illinois River. The Illinois River is the discharge point for groundwater in the alluvial deposits. Additional information regarding the groundwater flow beneath the plant property was obtained from several hydrogeologic investigations completed by RMT. Groundwater was encountered within the engineered fill, the underlying native silty clay, and the foundry sand fill in the Swale Area. Groundwater investigations and regular monitoring activities conducted in the vicinity of the 817 landfill demonstrate groundwater flow in the alluvial deposits to be consistently southerly, towards the Illinois River.[10]

As expected, hydraulic conductivity values vary widely based upon the composition of the formations. Sand and gravel deposits exhibit hydraulic conductivity values in the 10^{-2} to 10^{-4} cm/s range, while silt and clay units exhibited hydraulic conductivity values in the 10^{-7} to 10^{-9} cm/s range.

[10] Residual Management Technology, Inc., Groundwater Assessment Report, October 1996, p 11.

3.0 SWALE AREA INVESTIGATIONS

3.1 RCRA DRUM STORAGE AREA INVESTIGATION

Caterpillar conducted soil sampling activities associated with the closure of a former RCRA Drum Storage Area (located in the eastern part of the Swale Area), which formerly abutted the southwest corner of the CILCO transformer yard (Figure 3.1). PCBs were detected in the soil that had been excavated from the Drum Storage Area that was sampled in accordance with IEPA requirements. In response to this finding, Caterpillar undertook a soil sampling program in the Drum Storage Area to determine the extent of the PCBs detected in the soil. Caterpillar's investigations were performed in several stages during the period from May to July 1998, as Caterpillar expanded the investigation beyond the Drum Storage Area to delineate the extent the PCB impacted soils within other parts of the Swale Area. The CILCO electrical substation located near the Drum Storage Area was suspected initially to be the source of the PCBs. However, the results of the soil investigations suggested that the CILCO electrical substation was not the source of the PCBs.

Caterpillar advanced 53 soil borings in the Swale Area proximal to the former Drum Storage Area. Soil encountered in the boreholes included foundry sand fill, underlain by a native clay layer. Soil borings were advanced to the top of the underlying clay layer, generally present at depths of 8 and 13 feet bgs. The soil boring locations from Caterpillar's investigations are illustrated on Figure 3.2. Soil samples were submitted to Daily Analytical Laboratories of Peoria, Illinois (Daily) for PCB analysis. Daily has since consolidated with PDC Laboratories of Peoria, Illinois.

3.2 ADDITIONAL SOIL INVESTIGATIONS

An additional 36 soil borings were advanced in the Swale Area under the supervision of CRA following an evaluation of the soil analytical data obtained by Caterpillar. The intent of the additional soil borings was to delineate the vertical and horizontal extent of PCB-containing soil. The locations of these soil borings are illustrated on Figure 3.3. These soil borings were advanced during several phases to allow receipt and evaluation of the soil analytical data and scoping of subsequent phases of the investigation.

The first phase of soil investigation was performed on December 1 and 2, 1998, and included advancement of 14 soil borings (identified as locations B-1 through B-14) within the Swale Area. The soil borings were advanced on the points of a grid that was established and staked by a registered land surveyor. Seven of the soil borings (B-2 through B-8) were spaced most densely around the perimeter of the former Drum

Storage Area. The intent of these soil borings was to obtain independent confirmation of the presence of PCBs from an environmental laboratory not previously used by Caterpillar for this program. One soil boring (B-1) was advanced inside the former Drum Storage Area.

The second phase, completed in February 1999, included advancement of five additional soil borings (identified as B-15 through B-19) within the Swale Area. The third phase, completed in September 1999, included advancement of three soil borings (B-20, B-21, and B-26) within the Swale Area. The fourth phase, completed in April 2005, included advancement of 14 soil borings (identified as B-53 through B-66) within the Swale Area.

Table 3.1 provides a summary of CRA soil samples collected in 1998, 1999, and 2005. A summary of CRA drilling and soil sampling protocols is provided in Appendix D. Soil boring stratigraphic logs are provided in Appendix E.

3.3 GROUNDWATER INVESTIGATION

Three groundwater monitoring wells (MW-99A, MW-99B, and MW-99C) were installed within the Swale Area on November 15 and 16, 1999, at the locations shown on Figure 3.4. These monitoring wells were installed at the downgradient edge of the Swale Area to determine if dissolved PCBs were present in the groundwater within, and potentially migrating from, the Swale Area.

Following installation, the monitoring wells were developed to establish hydraulic communication with the aquifer and reduce the volume of sediment in the monitoring wells. Monitoring wells MW-99A and MW-99C were sampled on December 16, 1999. Monitoring well MW-99B was only purged dry on this date due to the extremely slow recharge rate of this well and was sampled on January 6, 2000. A summary of the field parameters measured during well development is provided in Table 3.2.

A summary of CRA monitoring well installation, development, and sampling protocols is provided in Appendix D. Table 3.1 provides a summary of groundwater samples collected in 1999 and 2000. Stratigraphic and instrumentation logs for the monitoring wells are provided in Appendix F.

3.4 HYDRAULIC MONITORING

The depth to groundwater was measured at the three new monitoring wells (MW-99A, MW-99B, and MW-99C) and three existing monitoring wells/piezometers (G101S, G102S, and P-109) to assist with the evaluation of shallow groundwater flow beneath the Swale Area. Depth to water measurements were taken on November 19, 1999, December 16, 1999, and February 11, 2000. The depth to groundwater measurements and the surveyed top of casing elevations of the monitoring wells were used to calculate the groundwater elevations. A summary of the calculated groundwater elevations is provided in Table 3.3.

4.0 INVESTIGATIVE FINDINGS

4.1 SOIL ANALYTICAL DATA

4.1.1 CATERPILLAR INVESTIGATIONS

In total, 107 individual soil samples were collected from the Swale Area by Caterpillar during the 1998 soil investigations and submitted to Daily for PCB analysis. PCBs were detected in 49 of the 53 soil borings and in 106 of the 107 samples analyzed. PCB concentrations ranged from non-detect in the sample collected from the 5- to 6-foot depth interval of EX-1 to 340 mg/kg in the soil sample collected from the 4- to 5-foot interval of R-19A. The most elevated PCB detections were noted in the soil samples collected from the foundry sand layer. All PCB detections were reported as Aroclor 1242 by the project laboratory.

The analytical results for soil samples collected by Caterpillar are summarized in Table 4.1. Figure 4.1 depicts the maximum detected concentration of PCBs in soil at each of the soil borings advanced under the supervision of Caterpillar.

4.1.2 CRA INVESTIGATIONS

During the 1998 and 1999 soil investigations, soil samples were collected from the Swale Area by CRA and submitted to Quanterra Incorporated of North Canton, Ohio for PCB analysis. Soil samples collected during the 2005 soil investigation were analyzed by STL North Canton (the successor to Quanterra Incorporated). The analytical results from the soil sampling program completed by CRA are summarized in Table 4.2. Data validation memoranda are provided in Appendix G. Copies of the laboratory analytical reports are reproduced in Appendix H. Soil analytical data are summarized on Figure 4.2.

Thirty-six soil borings (B-1 through B-21, B-26, and B-53 through B-66) were advanced in the Swale Area, and 145 soil samples were submitted for PCB analyses. Figure 4.2 depicts the soil boring locations and summarizes the soil detected analytical results. PCB concentrations ranged from non-detect at many locations/intervals to a maximum of 1,200 mg/kg in the soil sample collected from the 6- to 7-foot interval at soil boring B-56. Aroclors 1242 and 1248 were the PCB species detected most frequently in the soil samples. These Aroclors are typically used in hydraulic fluids, which is the suspected source of these compounds. PCB-containing hydraulic fluids were phased out of use in the 1970s and are no longer used at the Mapleton plant.

The following provides a summary of maximum PCB detections in the soil samples collected by CRA in the Swale Area during the 1998, 1999, and 2005 investigations:

Maximum Detected PCB Concentration	*No. of Borings*	*Boring Location/ (Depth Interval)*
>500 mg/kg	3	B-2 (4-6 feet) B-9 (6-8 feet) B-56 (6-7 feet)
>100 up to 500 mg/kg	4	B-7 (2-4 feet) B-8 (5-7 feet) B-11 (8-9 feet) B-15 (6-8 feet)
>50 up to 100 mg/kg	8	B-1 (4-6 feet) B-6 (6-8 feet) B-10 (2-4 feet) B-12 (0-2 feet) B-55 (6-7 feet) B-60 (4-6 feet) B-63 (0-2 feet) B-66 (0-2 feet)
>10 up to 50 mg/kg	10	B-5 (6-8 feet) B-13 (6-8 feet) B-16 (4-6 feet) B-19 (2-4 feet) B-54 (6-7 feet) B-57 (0-2 feet) B-59 (0-2 feet) B-61 (2-4 feet) B-62 (0-2 feet) B-64 (6-8 feet)
10 mg/kg or less	11	B-3 B-4 B-14 B-17 B-18 B-20 B-21 B-26 B-53 B-58 B-65

Figures 4.3 and 4.4 provide cross-sectional views within the Swale Area. As illustrated on these figures, the foundry sand was placed in areas that are surrounded with clay. Stratigraphic information from soil borings completed within the Swale Area indicates that the foundry sand is underlain by clay throughout the area. Ten soil borings (B-3, B-4, B-12, B-14, B-17, B-18, B-53, B-59, B-63, and B-64) contacted the underlying clay unit, and samples collected from the clay were analyzed for PCBs. PCBs were not detected in nine of the ten soil samples collected from clay. PCBs were detected at a concentration of 0.062 mg/kg in one sample collected from the 8- to 10-foot depth interval at B-64. However, foundry sand fill was present immediately above this layer, and the detection is likely the result of some sand becoming mixed with clay in the sample. These data indicate that the detections of PCBs occur in the foundry sand fill and not in the underlying clay layer.

4.2 GROUNDWATER FLOW

Groundwater flow beneath the Swale Area was evaluated by measuring the groundwater elevation in the three new monitoring wells installed within the Swale Area (MW-99A, MW-99B, and MW-99C), two existing monitoring wells (G-101S and G-102S), and one existing piezometer (P-109S). Monitoring wells MW-99A, MW-99B, and MW-99C were screened at depths ranging from approximately 17 to 17.5 feet. Monitoring wells G-101S and G-102S are approximately 18 feet and 15 feet deep, respectively. Piezometer P-109S is approximately 17 feet deep. All are constructed with 10 feet of slotted well screen.

Groundwater elevation data are summarized in Table 3.3, and the groundwater elevation data from the November 19, 1999, December 16, 1999, and February 11, 2000 monitoring events are illustrated on Figures 4.5, 4.6, and 4.7, respectively. The groundwater elevation data from monitoring well MW-99B is not expected to represent static conditions due to the extremely slow recharge rate of water into the well (the well was dry when the November 19, 1999 depths to water were measured and had a 5- to 10-foot lower groundwater elevation during subsequent events). The screened interval for MW-99B penetrates 4 feet of the foundry sand fill and 6 feet of the underlying clay unit whereas monitoring wells MW-99A and MW-99C penetrate the native upper sand unit, which appear to be acting as distinct hydrostratigraphic units. Therefore, monitoring well MW-99B groundwater elevation data was not used when developing the groundwater contours.

Evaluation of the groundwater elevation data indicates the presence of a groundwater high (mound) within the Swale Area. This conclusion is supported by the fact that the groundwater elevations are the highest at monitoring wells MW-99A and MW-99C, suggesting a radial flow outward from the Swale Area. The radial groundwater flow pattern suggests that groundwater flow in the Swale Area is driven by precipitation rather than local or regional gradient effects. Precipitation falling on the Swale Area would infiltrate the foundry sand deposits relatively quickly and percolate much more slowly into the underlying clay layer.

As discussed previously, the Swale Area was a low-lying area formed by the engineered fill walls and underlain by a native clay unit. Permeability testing of the clay unit indicates a vertical hydraulic conductivity of 4.2×10^{-8} cm/sec, indicating that the underlying clay would act as an aquitard. The lower hydraulic conductivity of the engineered clay sidewalls and the native clay base of the Swale Area would slow infiltration to deeper levels and inhibit lateral flow within the foundry sand fill, resulting in the observed local groundwater mounding effect.

The magnitude of the groundwater mounding would vary depending upon the amount of precipitation. Most likely, the groundwater mounding effect in the Swale Area is more pronounced during periods of heavier precipitation when groundwater infiltration would be greater. This would result in higher water levels in the Swale Area. The condition would be less pronounced during dry periods. In light of this information, the observed radial groundwater flow pattern is consistent with the known conditions.

4.3 GROUNDWATER ANALYTICAL DATA

Groundwater samples were collected from monitoring wells located within the Swale Area on December 16, 1999 (MW-99A and MW-99C) and on January 6, 2000 (MW-99B). PCBs were not detected at a quantitation limit of 1.0 milligram per liter (mg/L) in the groundwater samples collected from the three monitoring wells.

The data validation memorandum is provided in Appendix G. A copy of the laboratory analytical report is provided in Appendix H.

5.0 HUMAN HEALTH RISK ASSESSMENT

5.1 INTRODUCTION

A Human Health Risk Assessment (HHRA) was completed for two discrete areas within the Swale Area that is the focus of this RI. The first area, referred to as the West Swale Area, is located in the vicinity of Building R and extends south to the fence line. The second area, referred to as the East Swale Area, is located south of Buildings V and P and extends south to the railroad. Figure 5.1 delineates the two areas within the Swale Area that are evaluated in this HHRA. The Swale Areas were characterized to determine the potential current and future threats, if any, to human health associated with PCB residuals identified in soil in these areas. The current and likely continued future use of the Swale Area is as an industrial property.

The HHRA was conducted following the general format proposed in U.S. EPA guidance for Superfund risk assessments. In addition, the U.S. EPA PCB Risk Assessment Review Guidance Document and the guidance specified in the 40 CFR Part 761 Disposal of Polychlorinated Biphenyls (PCBs); Final Rule were used in completing the HHRA.

Specific guidance utilized in the development of the HHRA includes:

i) U.S. EPA Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A) (RAGS), EPA/540/1-89/002, December 1989

ii) U.S. EPA RAGS Supplemental Guidance, Standard Default Exposure Factors, OSWER Directive 9285.6-03, March 25, 1991

iii) U.S. EPA Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Publication 9285.7-081, May 1992

iv) U.S. EPA Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites, Office of Emergency and Remedial Response, OSWER 9285.6-10, December 2002

v) U.S. EPA Exposure Factors Handbook, EPA/600/P-95/002Ba, August 1997

vi) U.S. EPA RAGS Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments, Final, Publication 9285.7-01D, December 2001

vii) USEPA RAGS Part E, Supplemental Guidance, Dermal Risk Assessment, Final, July 2004

viii) USEPA RAGS Part F, Supplemental Guidance for Inhalation Risk Assessment, Final, January 2009

ix) U.S. EPA Disposal of Polychlorinated Biphenyls (PCBs); Final Rule, 40 CFR Part 761, Federal Registrar Volume 63. No. 124, June 29, 1998, Rules and Regulations

x) U.S. EPA RAGS Vol. 1: Human Health Evaluation Manual, Part E Supplemental Guidance for Dermal Risk Assessment, Final, July 2004

xi) U.S. EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Site. OSWER Directive 9355.4-24, December 2002

xii) U.S. EPA Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment Bulletins EPA Region 4, May 2000 (USEPA, 2000a)

xiii) U.S. EPA PCB Risk Assessment Review Guidance Document, Interim Draft, January 2000 (USEPA, 2000b)

xiv) U.S. EPA, Child-Specific Exposure Factors Handbook, September 2008

xv) other applicable guidance and reference documents referenced herein

5.1.1 SCOPE AND ORGANIZATION OF THE HHRA

The HHRA has been prepared in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 1990) and applicable U.S. EPA guidance. The HHRA utilizes validated analytical data generated from previous investigations. The validated data was used to evaluate the potential current and future impact, if any, to human health based on exposure to PCBs identified in the Swale Area.

The HHRA is focused on direct dermal and incidental ingestion exposure to PCB Aroclors and total PCBs present in the Swale Area. In addition, the soil-to-ambient air exposure pathway was quantified in the HHRA where applicable. Other potential exposure pathways, such as soil-to-groundwater protection, were not considered significant for the exposure areas and, thus, were not quantitatively evaluated in this HHRA. PCBs in the soil of the Swale Area are not expected to leach to groundwater due to their high affinity to stay sorbed to organic rich media, such as soil (U.S. EPA, 2000b).

Table 1.0 of Appendix I presents a summary of the exposure pathway scenarios selected for evaluation in the HHRA. Under the current condition, there is potential for direct incidental ingestion, dermal contact, and inhalation of airborne particulate of PCBs in soil from the Swale Area by industrial workers and trespassers. Under the future condition, there is potential for direct incidental ingestion, dermal contact, and inhalation of airborne particulate of PCBs in soil from the Swale Area by industrial workers, trespassers, and construction workers.

A HHRA generally incorporates the following major segments:

i) Site Characterization - information relevant to the RA describing the past and current use and condition of the Swale Area and surrounding area is presented, in addition to the presentation of data;

ii) Identification of Chemicals of Potential Concern (COPCs) - the presence, distribution, and concentration of chemicals detected in affected media are identified and evaluated. PCB Aroclors are the COPCs based on Swale Area soil analytical data

iii) Exposure Assessment - potential exposure pathways are evaluated to identify possible receptors and to determine how these receptors could be exposed to the COPCs; exposure point concentrations and the daily chemical intakes for receptors are estimated

iv) Toxicity Assessment - toxicity factor data are identified for COPCs from which potential health effects associated with chemical exposure are estimated

v) Risk Characterization - estimates of potential carcinogenic risks and non-carcinogenic hazards are calculated for each potentially complete exposure pathway based on the results of the exposure and toxicity assessments. A section on the uncertainties identified in the RA process is included

The HHRA process applies several theoretical assumptions to determine a numerical expression of both carcinogenic and non-carcinogenic risks to human health. The HHRA characterizes potential carcinogenic effects in terms of probabilities that an individual will develop cancer over a lifetime based on an exposure period to hazardous constituents related to the Swale Area. The potential for non-carcinogenic effects is evaluated by comparing an estimated daily intake level from potential exposures to a reference dose which is defined as the intake level at which a receptor can be exposed through their entire lifetime without experiencing appreciable adverse health effects. The results of the evaluation of carcinogens and non-carcinogens are compared to acceptable levels determined by the U.S. EPA.

Agency guidelines require that the estimates of potential carcinogenic risk and non-carcinogenic hazard be based on the reasonable maximum exposure (RME), which could result from the presence of reported residues of hazardous constituents.

5.1.2 ANALYTICAL DATA

A comprehensive description of the investigations that have been conducted in the Swale Area is presented in Section 3.0, while a description of the analytical data collected from the previous investigations is presented in Section 4.0. Caterpillar and CRA collected soil sample data as part of their investigations. All analytical soil data collected from the Swale Area from both the Caterpillar and the CRA investigations have been used in the HHRA to estimate risks and hazards to potential human receptors. Soil data from samples collected from a depth of 0 to 2 feet bgs were used to characterize potential risk to receptors exposed to surface soils, while soil data from samples collected from a depth of 0 to 12 feet bgs were used to characterize potential risk to receptors exposed to surface and subsurface soils combined. Table 4.1 presents a summary of the soil analytical results from the Caterpillar investigations, and Table 4.2 presents a summary of the soil analytical results from the CRA investigations. CRA also collected groundwater data from the three monitoring wells in the Swale Area in December 1999/January 2000. PCBs were not detected in the groundwater samples collected from the three monitoring wells.

Following PCB Risk Assessment Guidance (U.S. EPA, 2000b), if Aroclors are analyzed individually, the Aroclor results should also be summed to calculate risks from total PCBs. The total PCB concentration for each soil sample was determined by summing the positively detected Aroclor results for that sample. Thus, to avoid duplication, the risks and hazards resulting from exposure to PCB Aroclors and total PCBs were separately estimated for each evaluated exposure scenario.

Analytical data were reviewed for validation qualifiers on concentration values and sample duplicates. Rejected samples ("R" qualifiers) were not included in the database for the risk assessment. Estimated results, usually indicated by a "J" qualifier, were included in the evaluation. Duplicate samples were averaged and considered as one sample.

5.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

In general, the primary purpose of identifying the COPCs is to determine which detected chemicals are predominantly significant from a toxicity and occurrence perspective, so that potential remedial efforts can be focused on those chemicals contributing the majority of potential risk. In the West Swale Area and the East Swale Area, PCBs have been identified as COPCs based on detections in surface soil and soil (surface and subsurface soil). Detected PCB Aroclors, as well as total PCBs, were identified as COPCs for the datasets from each of the two Swale Areas.

The available sample data were evaluated to summarize the chemical detection frequencies, the minimum and maximum detected concentrations, and the locations of the maximum detected concentrations consistent with U.S. EPA RAGS Part D guidance (2001). Tables 2.1 and 2.3 of Appendix I present the occurrence, distribution, and selection of the surface soil COPCs in West Swale Area and East Swale Area, respectively. Tables 2.2 and 2.4 of Appendix I present the occurrence, distribution, and selection of the soil (surface and subsurface) COPCs in West Swale Area and East Swale Area, respectively. Table 2.5 of Appendix I presents the occurrence, distribution, and selection of groundwater COPCs in East Swale Area. All PCBs analyzed within the groundwater were not detected. On this basis, and due to the lack of leaching potential for PCBs because of their affinity to stay sorbed to organic matter present in soils (U.S. EPA, 2000b), there are no groundwater COPCs. As a result, the groundwater medium is not evaluated further in the HHRA.

5.3 EXPOSURE ASSESSMENT

5.3.1 POTENTIAL HUMAN EXPOSURE PATHWAYS

To determine whether an exposure to COPCs remaining in a medium exists, the environmental and human components that lead to human exposure must be evaluated.

An exposure pathway consists of four necessary elements:

i) A source and mechanism of chemical release to the environment
ii) An environmental transport medium
iii) A point of potential human contact within the impacted medium (exposure point)
iv) A human exposure route (ingestion, dermal contact, or inhalation) at the contact point

Exposure pathways are classified as complete, potential, or incomplete. For an exposure pathway to be complete, the aforementioned four elements must be present, which indicates that the exposure is occurring or will occur in the future. Potential exposure pathways have one element presently missing, which indicates that the exposure pathway may be complete in the future. Incomplete exposure pathways have one or more elements missing which are not present and will likely never be present and thus are not complete.

Table 1.0 of Appendix I presents a summary of the exposure pathways identified for analysis in the HHRA. Land use is an important consideration in determining the exposure pathways of concern at any particular site. It is anticipated that the current industrial use of the Swale Area will continue to remain the same under the future land use condition.

The following section provides the rationale for selecting or eliminating exposure pathways for quantitative analysis in the HHRA based on the current and future intended land uses.

5.3.2 EXPOSURE PATHWAY DETERMINATION

Exposure pathways were determined to be complete, potentially complete, or incomplete based on the current and future intended industrial land use of the Swale Area, the presence of the PCBs in the West and East Swale Areas, and the anticipated human activity patterns in the area.

Surface Soil

The current and future anticipated use of the Swale Area, and in the areas of focus in this HHRA, is that of an on-site industrial worker. It is possible that an industrial worker could be exposed to PCBs present in surface soils in the West Swale Area and East Swale Area through incidental ingestion, dermal contact, and inhalation of airborne particulates.

The West Swale Area is an area of higher activity, and thus, for the purpose of this HHRA, was considered a "high occupancy" area. As defined in 40 CFR 761, Disposal of PCBs; Final Rule Details, a high occupancy area means any area where PCB remediation waste has been placed, and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is 335 hours or more (equal to or greater than 6.7 hours per day) for bulk waste. As the West Swale Area is defined as a high occupancy area, an industrial worker was conservatively assumed to be exposed to West Swale Area surface soil for 8 hours per day for 250 days per year. This is consistent with U.S. EPA (2002).

The East Swale Area is not a high activity area and, therefore, it is appropriate to assume that an industrial worker will not be exposed to the Swale Area surface soils at as high a rate as might a typical industrial worker. Thus, the East Swale Area was treated as a "low occupancy" area, and a low occupancy industrial worker exposure scenario was evaluated in the HHRA. As defined in 40 CFR 761, Disposal of PCBs; Final Rule Details, a low occupancy area means any area where PCB remediation waste has been placed and where occupancy for any individual not wearing dermal and respiratory protection for a calendar year is less than 335 hours (an average of 6.7 hours/week) for bulk waste.

The nearest residential areas are located across Highway 24/9, a limited access divided highway. Although unlikely, due to physical features, it is possible that individuals may trespass on the Swale Area both currently and in the future. The trespassers were assumed to be adolescents who may be exposed to PCBs present in surface soils in the West and East Swale Areas through incidental ingestion, dermal contact, and inhalation of air-borne particulate. Although the Swale Areas are small relative to the entire plant property, it was assumed that the trespassers would spend their entire time within the Swale Area exposed to surface soil in one of these two areas.

Total Soil

It is possible that some construction activities could occur within the Swale Area at some time in the future. Thus, future construction worker exposures to Swale Area soil were evaluated in the HHRA for both the West and East Swale Areas. It is assumed that the construction activities would be comprised of a short-term excavation event typical of utility trenching work. The construction worker was assumed to be exposed to PCBs present in soils in the Swale Areas at depths from 0 to 12 feet bgs through incidental ingestion, dermal contact, and inhalation of air-borne particulate.

Groundwater

The soil leaching to groundwater exposure pathway is considered incomplete for the due to the lack of leaching potential for PCBs and their affinity to stay sorbed to organic matter present in soils (U.S. EPA, 2000b). In addition, stratigraphic information from soil borings completed within the Swale Area indicates that the foundry sand is underlain by clay throughout the area. PCBs were not detected in the groundwater samples collected from the monitoring wells located within the Swale Area (see Table 2.5 of Appendix I). Thus, although PCBs have been detected in the soil in both the East and West Swale Areas, no impact to groundwater resulting from the presence of this material in these areas has been observed, nor is expected to occur under the future condition.

5.3.3 EXPOSURE POINT CONCENTRATIONS

Two levels of assumptions are presented in this HHRA. The Central Tendency (CT) assumptions present the average or mean exposure point concentration (EPC) values and approximate the most probable exposure conditions. The RME are conservative assumptions that generally utilize the 90th to 95th percentile EPC values, depending upon available data.

The CT and RME EPC values for the various exposure scenarios were determined based on the observed data distribution and the percentage of censored data points (non-detected results). Both the CT and RME EPC values have been conservatively based on the 95 percent upper confidence limit (UCL) of the mean. Appendix J contains a detailed description of the statistical methods used to determine the 95 percent UCL values.

Tables 3.1 and 3.3 of Appendix I present the calculated arithmetic mean concentrations, the maximum detected concentrations, and the 95 percent UCL concentrations for surface soil in West and East Swale Areas, respectively. Tables 3.2 and 3.4 of Appendix I present the calculated arithmetic mean concentrations, the maximum detected concentrations, and the 95 percent UCL concentrations for soil in the West and East Swale Areas, respectively.

5.3.4 QUANTIFICATION OF EXPOSURE

To quantify exposures, potential exposure scenarios were developed using exposure assumptions presented in U.S. EPA guidance documents. In instances where the U.S. EPA documents did not present the necessary assumptions and where specific appropriate exposure information was not available, professional judgment was used to develop conservative and health protective exposure assumptions. The CT and RME assumptions were noted for each exposure scenario evaluated.

5.3.5 EXPOSURE ESTIMATES

In the HHRA, the magnitude of exposure reflects the chemical concentration, contact rate, exposure time, and body weight. This section outlines the approach for determining the amount of the identified COPCs to which the selected receptors may be exposed via the media.

5.3.5.1 SPECIFIC INTAKE EQUATIONS

The following sections provide the intake equations for ingestion, dermal, and inhalation exposure to soil that were applied in the HHRA. In the HHRA, exposure estimates reflect chemical concentration, contact rate, exposure time, and body weight in a term called "intake" or "dose".

Incidental Ingestion of Soil Exposure Pathway

The intake equation for calculating chemical intake from the incidental ingestion of soil (USEPA, 1989) is:

$$CDI = \frac{CS \times IR \times CF \times EF \times ED}{BW \times AT} \qquad \text{Equation 1}$$

Where:

CDI	=	chronic daily intake (mg/kg body weight/day)
CS	=	chemical concentration in soil (mg/kg)
IR	=	incidental ingestion rate (mg soil/day)
CF	=	conversion factor (kg/10^6 mg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time [period over which exposure is averaged] (days)

Soil Dermal Contact Exposure Pathway

The intake equation for calculating chemical intake from dermal exposure to soil (USEPA, 1989) is:

$$CDI = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT} \qquad \text{Equation 2}$$

Where:

CDI	=	chronic daily intake (mg/kg body weight/day)
C	=	chemical concentration in soil (mg/kg)
CF	=	conversion factor (kg/10^6 mg)
SA	=	skin surface area available for contact (cm^2/event)
AF	=	soil to skin adherence factor (mg/cm^2)
ABS	=	chemical absorption rate (unitless)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
ED	=	event frequency (events/day)
BW	=	body weight (kg)
AT	=	averaging time (averaging period, days)

Soil Particulate or Vapor Inhalation from Soil Exposure Pathway

The intake equation for calculating chemical intake from the inhalation of particulate or vapors originating from soil is, after USEPA (2002a):

$$CDI = \frac{CS \times FT \times EF \times ED}{VF \times AT} \qquad \text{Equation 3}$$

Where:

CDI	=	chronic daily intake via particulate and soil vapor inhalation (mg/m^3)
CS	=	chemical concentration in soil (mg/kg)
FT	=	fraction of time exposed (hours per 24 hours) (unitless)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
VF	=	volatilization factor (m^3/kg)
AT	=	averaging time (averaging period, days)

For carcinogens, a lifetime average daily dose of the chemical is estimated which pro-rates the total cumulative intake over a lifetime. An averaging time (AT) of 70 years is applied for carcinogens.

For non-carcinogens, the chemical intake is estimated over the appropriate exposure period or averaging time. The averaging time selected depends on the exposure duration of the specific population being evaluated and the toxic endpoint being assessed.

5.3.5.2 EXPOSURE SCENARIO ASSUMPTIONS

Separate exposure scenarios were developed for each receptor population exposure evaluated in the HHRA. A description of each exposure scenario and the associated exposure assumptions are presented in the following subsections.

5.3.5.2.1 SURFACE SOIL EXPOSURES

a) Current/Future Trespasser Exposure to Surface Soil

The trespasser exposure scenario for the current/future Swale Area condition was developed to reflect infrequent and occasional trespasser exposure to surface soils in the West and East Swale Areas. The trespasser was assumed to be an adolescent who would gain unauthorized access to the Swale Area for trespassing activities. Table 4.1 of

Appendix I presents a summary of the conservative and health-protective assumptions that were used to calculate the trespasser exposure.

The exposure assumptions are described as follows:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME scenarios.

  Note: The current/future surface soil datasets include all soil results from 0 to 2 feet bgs for the West Swale Area and East Swale Area.

- The trespasser is an adolescent between ages 8 and 17 years old (U.S. EPA, 2000a).
- The inadvertent soil ingestion rate for the trespassers is 100 mg/per daily trespass event for both the CT and RME (U.S. EPA, 1991).
- The exposed skin surface area for the trespasser is 3,500 cm^2 for both the CT and RME. The exposed skin surface area is based on variations of the amount of clothing cover provided during different times of the year and involves the estimation that 25 percent of the total body surface area may be exposed to direct soil contact (U.S. EPA, 1997). Table 6-6 of the Exposure Factors Handbook (U.S. EPA, 1997) presents the total body surface area of male children. Taking the average of the 50th percentile total body weights of the 8 to 17 year old male child results in a total body surface area of 14,160 cm^2. Applying the 25 percent exposed skin factor results in an exposed skin surface area of approximately 3,500 cm^2.
- The soil-to-skin adherence factor is 0.04 mg/cm^2 (CT) and 0.2 mg/cm^2 (RME) based U.S. EPA (2004) recommended values for dry soil.
- The dermal absorption factor is 14 percent for PCBs (U.S. EPA, 2004).
- The exposure frequency is 8 days/year for the CT and 16 days/year for the RME. The RME exposure frequency is based on trespassing occurring twice a month for 8 months. It is assumed that trespassing will occur primarily during the warmer months of the year. Limited soil contact will occur over the winter months of the year when surface soils are either covered by snow, frozen, or constantly wet.
- The exposure duration for the trespasser is 10 years (CT and RME) (U.S. EPA, 2000a).
- The body weight for the trespasser is 45 kg. Data in Tables 7-6 and 7-7 of the Exposure Factors Handbook (U.S. EPA, 1997) were used to derive the trespasser body weight by averaging the 50th percentile body weight for male and female children aged 8 to 17 years old.
- The carcinogenic averaging time is 75 years times 365 days per year or 27,375 days (U.S. EPA, 2000b). The averaging time for non-carcinogens is 365 times the exposure duration (ED).

b) <u>Current/Future High Occupancy Industrial Worker Exposure to Surface Soil in West Swale Area</u>

A high occupancy industrial worker exposure to surface soils was evaluated under the current/future condition in the West Swale Area. Table 4.3 of Appendix I presents a summary of the conservative and health-protective assumptions that were used to calculate the industrial worker exposure, as appropriate.

The exposure assumptions are described as follows:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.

  <u>Note:</u> The current/future surface soil datasets include all soil results from 0 to 2 feet bgs for the West Swale Area.
- The ingestion rate of soil is 50 mg soil/day for both the CT and RME (U.S. EPA, 1991).
- The exposed skin surface area for the industrial worker is 3,300 cm^2 for the CT and RME, based on U.S. EPA (2002) recommended values.
- The soil-to-skin adherence factors are 0.02 mg/cm^2 (CT) and 0.2 mg/cm^2 (RME) based on U.S. EPA (2004) recommended values.
- The dermal absorption factor is 14 percent for PCBs (U.S. EPA, 2004).
- The exposure frequency is 250 days/year for the CT and RME (U.S. EPA, 1991).
- The exposure durations for the worker are 9 years (CT) (U.S. EPA, 1991) and 25 years (RME) (U.S. EPA, 2002) based on the length of time the worker is employed at the same job.
- The body weight for the adult worker is 70 kg (U.S. EPA, 2002).
- The carcinogenic averaging time is 75 years times 365 days per year or 27,375 days (U.S. EPA, 2000b). The averaging time for non-carcinogens is 365 times the exposure duration (ED).

c) <u>Current/Future Low Occupancy Industrial Worker Exposure to Surface Soil in East Swale Area</u>

A low occupancy industrial worker exposure to Swale Area surface soils was evaluated under the current/future condition in the East Swale Area. Table 4.4 of Appendix I presents a summary of the conservative and health-protective assumptions that were used to calculate the industrial worker exposure, as appropriate.

The exposure assumptions are the same as those outlined for the Current/Future Industrial Worker Scenario for the West Swale Area, with the exception of the following:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.

  Note: The current/future surface soil datasets include all soil results from 0 to 2 feet bgs for the East Swale Area.
- The exposure frequency for the industrial worker is 50 weeks/year for the CT and RME (U.S. EPA, 1991).
- The inadvertent soil ingestion rate for the industrial worker is 50 mg/day, or 6.25 mg/hour for an 8-hour workday, for both the CT and RME (U.S. EPA, 1991).

5.3.5.2.2 SOIL EXPOSURE

a) Future Construction Worker Exposure to Soils

A hypothetical construction worker exposure to Swale Area soils during utility excavation activities was evaluated under the future condition. Table 4.5 of Appendix I presents a summary of the conservative and health-protective assumptions that were used to calculate the construction worker exposure, as appropriate.

The exposure assumptions are described as follows:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.

  Note: The future soil datasets include all soil results from 0 to 12 feet bgs for both Swale Areas.
- The inadvertent soil ingestion rate for the construction worker is 330 mg/day for both the CT and RME (U.S. EPA, 2002).
- The exposed skin surface area for the construction worker is 3,300 cm^2 for the CT and RME, based on U.S. EPA (2002) recommended values.
- The soil-to-skin adherence factors are 0.1 mg/cm^2 (CT) and 0.3 mg/cm^2 (RME) based on U.S. EPA (2004) guidance.
- The dermal absorption factor is 14 percent for PCBs (U.S. EPA, 2004).
- The exposure frequency for the construction worker is 5 days/year for a 1-week excavation event (CT) and 20 days/year for a 4-week or an approximate 1-month excavation event (RME).

- The excavation activities are expected to occur during a 1-year time period, thus the exposure duration is 1 year (CT and RME) (U.S. EPA, 2002).
- The body weight for the adult worker is 70 kg (U.S. EPA, 2002).
- The carcinogenic averaging time is 75 years times 365 days per year or 27,375 days (U.S. EPA, 2000b). The averaging time for non-carcinogens is 365 times the exposure duration (ED).

5.3.5.2.3 AMBIENT AIR EXPOSURE

a) Current/Future Trespasser Exposure to Ambient Air

The trespasser exposure scenario for the current/future condition includes exposure to airborne particulate originating from the West Swale Area surface soil. Table 4.1 of Appendix I includes a summary of the conservative and health-protective assumptions that were used to calculate the trespasser inhalation exposure.

The exposure assumptions for the trespasser inhalation exposure are the same as those presented in Section 5.3.5.2.1(a) except for the following:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.
- The fraction time exposed is 2 hours for the RME and 0.5 hours for the CT within a 24 hour period.
- The particulate emission factor (PEF) is calculated consistent with U.S. EPA (2002) and is presented in Table 4.2.

b) Current/Future High Occupancy Industrial Worker Exposure to Ambient Air in West Swale Area

A high occupancy industrial worker exposure to ambient air was evaluated under the current/future condition. Table 4.3 of Appendix I includes a summary of the conservative and health-protective assumptions that were used to calculate the industrial worker exposure, as appropriate.

The exposure assumptions for the industrial worker inhalation exposure are the same as those presented in Section 5.3.5.2.1(b) except for the following:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.
- The fraction time exposed is 8 hours for both the CT and the RME within a 24 hour period.
- The PEF is calculated consistent with U.S. EPA (2002) and is presented in Table 4.2

c) Current/Future Low Occupancy Industrial Worker Exposure to Ambient Air in East Swale Area

A low occupancy industrial worker exposure to ambient air was evaluated under the current/future condition. Table 4.4 of Appendix I includes a summary of the conservative and health-protective assumptions that were used to calculate the industrial worker exposure, as appropriate.

The exposure assumptions for the industrial worker inhalation exposure are the same as those presented in Section 5.3.5.2.1(c) except for the following:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.
- The fraction time exposed is 6.7 hours for both the CT and the RME within 120 hours (5 days times 24 hours per work week).
- The PEF is calculated consistent with U.S. EPA (2002) and is presented in Table 4.2.

d) Future Construction Worker Exposures to Ambient Air

A hypothetical construction worker exposure to ambient air while excavating was evaluated under the future condition. Table 4.5 of Appendix I presents a summary of the conservative and health-protective assumptions that were used to calculate the construction worker exposure, as appropriate.

The exposure assumptions for the future construction worker inhalation exposure are the same as those presented in Section 5.3.5.2.2(a) except for the following:

- The exposure point concentrations are the 95 percent UCL for both the CT and RME exposure scenarios.

- The fraction time exposed is 8 hours for both the CT and the RME within a 24 hour period.
- The PEF is consistent with U.S. EPA (2002) and is presented in Tables 4.6 and 4.7 for the West and East Swale Areas, respectively.

5.4 TOXICITY ASSESSMENT

The toxicity assessment weighs the available evidence regarding the potential for a particular COPC to cause adverse effects in exposed individuals and estimates the extent of exposure and possible severity of adverse effects. To develop toxicity values, two steps are taken: hazard identification and dose-response assessment. The hazard identification determines the potential adverse effects associated with exposure to a COPC. In the dose-response assessment, numerical toxicity values are determined or selected from the available toxicity data.

In the selection of toxicity values, preference has been given to the most recently developed values because these would incorporate the most recent toxicological information and would provide the best basis upon which to assess potential health hazards/risks.

5.4.1 NON-CARCINOGENIC HAZARDS

5.4.1.1 TOXICITY INFORMATION FOR NON-CARCINOGENIC EFFECTS

For substances suspected to cause non-carcinogenic chronic effects, the health criteria are usually expressed as chronic intake levels (Reference Dose or RfDs) (in units of mg/[kg-day]) or Reference Concentration (RfCs) (in units of mg/m^3) below which no adverse effects are expected. In other words, there is a level of exposure to a chemical below which no toxic effects are expected. In contrast to the toxicological model used to assess carcinogenic risk, which assumes no concentration threshold, the non-carcinogenic dose-response model postulates a "threshold".

In this risk assessment, chronic RfDs and RfCs are used as the toxicity values for non-carcinogenic health effects. A chronic RfD and RfC is defined as an estimate (with an uncertainty spanning an order of magnitude or greater) of a daily exposure level for the human population, including sensitive sub-populations, which poses no appreciable risk of deleterious effects over a lifetime of exposure. Uncertainty factors are incorporated into the RfDs or RfCs to account for extrapolations from animal toxicity data and for data quality, and to protect sensitive sub-populations. The basis of an RfD or RfC is usually the highest dose level administered to laboratory animals that did not cause observable adverse effects after chronic (usually lifetime) exposure. This is called the No-Observed Adverse Effect Level (NOAEL). The NOAEL is then divided by an uncertainty (safety) factor, and sometimes an additional modifying factor, to obtain the RfD or RfC. In general, an uncertainty factor of 10 is used to account for interspecies variation and another factor of 10 to account for sensitive human populations. Additional factors of 10 are included in the uncertainty factor if the RfD or RfC is based on the Lowest-Observed Adverse Effect Level (LOAEL) instead of the NOAEL, or if data inadequacies are present (e.g., the experiment for which the RfD or RfC was derived had less than lifetime exposure). The LOAEL is the dose level administered to laboratory animals that causes the lowest adverse effect (i.e., liver toxicity - although this is species and chemical-specific) after chronic exposure.

Non-cancer toxicity data for PCBs is limited, with published oral RfDs available only for Aroclor 1016. Non-cancer inhalation toxicity data for PCBs is not available. Thus, extrapolation from the oral-to-inhalation route was applied for Aroclor 1016.

Table 5.1 of Appendix I presents the non-cancer toxicity data (RfDs) used to estimate human health effects for oral and dermal exposure routes for all exposure areas. The dermal toxicity data presented in Table 5.1 of Appendix I was adjusted consistent with U.S. EPA (2004) guidance. Table 5.2 of Appendix I presents RfCs used for the inhalation exposure route for all exposure areas.

5.4.2 CARCINOGENIC RISKS

5.4.2.1 TOXICITY INFORMATION FOR CARCINOGENIC EFFECTS

Cancer Slope Factors (CSFs) and inhalation unit risk factors (URFs) are quantitative risk estimates of carcinogenic potency. Slope factors relate the lifetime probability of excess cancers to the lifetime average exposure dose of a substance. CSFs and URFs are estimated using mathematical extrapolation models, most commonly the linearized multistage (LMS) model, and are presented as risk per mg/(kg-day) (i.e., mg carcinogen per kg body weight per day) for oral CSFs and risk per mg/m^3 for inhalation URFs. These models assume low dose-response linearity and thus may not be appropriate for some suspect carcinogens, in particular those that function as promoters. As well, the body's natural repair processes and defense mechanisms may decrease cancer risk at low exposure levels. Thus, the risks at lower exposure levels are likely overestimated using the LMS model. When adequate human epidemiology data are available, maximum likelihood estimates (MLEs) of model parameters are used to generate a CSF or URF. When only animal data are available, the CSF or URF is derived from the largest possible linear slope that is consistent with the data (within the upper 95 percent confidence limit). In other words, the true risk to humans, while not identifiable, is not likely to exceed the upper-bound estimate. This is a conservative estimate, and in some cases a linear slope of zero may be as appropriate for the data (i.e., no carcinogenic risk).

The CSF or URF when multiplied by the lifetime average daily dose expressed will provide an estimate of the probability that the dose will cause cancer during the lifetime of the exposed individual. This increased cancer risk is expressed by terms such as 1E-06 or 1×10^{-6}. This is a hypothetical estimate of the upper limit of risk based on very conservative, health-protective assumptions and statistical evaluations of data from animal experiments or from epidemiological studies. To state that a chemical exposure causes a 1E-06 added upper limit risk of cancer means that if 1,000,000 people are exposed, one additional incident of cancer is expected to occur. The calculations and assumptions yield an upper limit estimate that indicates that no more than one case is expected, and, in fact, there may be no additional cases of cancer. U.S. EPA policy, as specified in the National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule (EPA 1990, Federal Register 55 FR 8666), has established that an upper limit cancer risk falling below or within the range of 1E-06 to 1E-04 is acceptable. Since U.S. EPA CSFs or URF represent 95 percent upper confidence levels, the calculated risks are 95 percent upper bound estimates. Thus, actual risks associated with exposure to a potential carcinogen are not likely to exceed the risks estimated using CSFs or URF, but may be lower.

The following chart further explains these cancer risk estimates:

Estimate of Excess Cancer Risk	*Maximum Number of Additional Cancer Cases Expected*	*Number of People in the Exposed Population*
1×10^{-6}	1	1,000,000
1×10^{-5}	1	100,000
1×10^{-4}	1	10,000

Known or suspect human carcinogens have been evaluated and identified by the Carcinogen Assessment Group using the U.S. EPA Weight-of-Evidence approach for carcinogenicity classification[11]. The U.S. EPA classification is based on an evaluation of the likelihood that the agent is a human carcinogen.

[11] U.S. EPA, Health Effects Assessment Summary Table, EPA 540/R-97-036, July 1997.

The evidence is characterized separately for human and animal studies as follows:

Group A-	Known Human Carcinogen (sufficient evidence of carcinogenicity in humans);
Group B-	Probable Human Carcinogen (B1 – limited evidence of carcinogenicity in humans; B2 – sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans);
Group C-	Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data);
Group D-	Not Classifiable as to Human Carcinogenicity (inadequate or no evidence); and
Group E-	Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in animal studies).

The COPCs were classified utilizing the U.S. EPA system. Table 6.1 of Appendix I presents the cancer toxicity data (CSFs) used in the HHRA to estimate the risk of cancer for the oral and dermal exposure routes for all exposure areas. The dermal toxicity data presented in Table 6.1 of Appendix I was adjusted consistent with U.S. EPA (2004) guidance. Table 6.2 of Appendix I presents URFs for the inhalation exposure route for all exposure areas.

5.5 RISK CHARACTERIZATION

The objective of this risk characterization is to integrate information developed in the exposure assessment (Section 5.3) and the toxicity assessment (Section 5.4) into a complete evaluation of the potential human health risks associated with exposure to soil potentially containing PCBs. The methods used in this risk characterization are based on U.S. EPA guidance for human exposures (U.S. EPA, 1989, 1991, 1997, 2001, 2002, 2004, 2008, 2009).

5.5.1 HAZARD ESTIMATES

The potential for non-cancer health effects from exposure to a COPC is evaluated by comparing an exposure level over a specified time period to a RfD or RfC for a similar time period. This ratio, termed the hazard quotient, is calculated according to the following general equation:

$$HQ = \frac{CDI}{RfD\ or\ RfC}$$

Where:

HQ = The Hazard Quotient (unitless) is the ratio of the exposure dose of a chemical to a reference dose not expected to cause adverse effects from a lifetime exposure. A hazard quotient equal to or below 1.0 is considered protective of human health.

CDI = The Chronic Daily Intake is the chemical dose calculated by applying the exposure scenario assumptions and expressed as mg/(kg-day). The intake represents the average daily chemical dose over the expected period of exposure.

RfD = The Reference Dose is a daily dose believed not to cause an adverse effect from even a lifetime exposure [mg/(kg-day)]. The RfD is based on experimental data and/or epidemiological studies.

RfC = The Reference Concentration is a daily concentration believed not to cause an adverse effect from even a lifetime exposure [mg/m^3]. The RfC is based on experimental data.

The Hazard Index (HI) is the sum of Hazard Quotients for individual COPCs for a specific exposure scenario.

The summation of non-carcinogenic effects is only additive as they pertain to similar target organs. The HIs presented in Section 5.5 conservatively sum the non-carcinogenic effects without regard to target organs. HIs summed across similar target organs are presented on the hazard quotient calculation tables for each exposure unit in their respective appendix.

The calculated HIs resulting from exposure to the COPCs are compared to a HI of 1. An HI equal to or below 1.0 is considered protective of human health over a lifetime and indicates that the exposure scenarios are not of concern. Typically, an HI between 1 and 10 suggests that exposure may reduce the margin of safety inherent in the exposure scenario and may be of possible concern for sensitive individuals. When the HI exceeds 10, there may be substantial concern for potential health effects. While any single COPC with an exposure level greater than the toxicity value will cause the HI to exceed 1, for multiple COPCs the HI can also exceed 1 due to the addition of multiple COPC HQs.

5.5.2 CANCER RISK ESTIMATES

Exposure scenarios may involve potential exposure to more than one carcinogen. To represent the potential carcinogenic effects posed by exposure to multiple carcinogens, it is assumed, in the absence of information on synergistic or antagonistic effects, that these risks are additive. Cancer risks are calculated utilizing the following general equation:

$$\text{Cancer Risk} = \text{LADD} \times (\text{CSF or URF})$$

Where:

Cancer Risk	=	Estimated upper bound on additional risk of cancer over a lifetime in an individual exposed to the carcinogen for a specified exposure period (unitless).
LADD	=	The Lifetime Average Daily Dose of the chemical calculated using exposure scenario assumptions and expressed in mg/(kg-day). The intake represents the total lifetime chemical dose averaged over an individual expected lifetime of 70 years.
CSF	=	The Cancer Slope Factor models the potential carcinogenic response and is expressed as $[mg/(kg\text{-}day)]^{-1}$.
URF	=	The inhalation Unit Risk Factor models the potential carcinogenic response and is expressed as $(mg/m^3)^{-1}$.

For estimating cancer risks from exposure to multiple carcinogens from a single exposure route, the following equation is used:

$$Risk_T = \sum_{i=1}^{N} Risk_i$$

Where:

$Risk_T$	=	Total cancer risk from route of exposure
$Risk_I$	=	Cancer risk for the chemical
N	=	Number of chemicals

The cumulative carcinogenic risks are presented and discussed in Section 5.5. The potential cumulative risks resulting from exposure to the COPCs are compared to a target risk range of 1E-06 to 1E-04. When a cumulative risk to an individual under the assumed exposure conditions in an exposure unit exceeds 1E-04, remedial actions may be necessary.

5.5.3 RISK QUANTIFICATION SUMMARY

The hazard indices and excess lifetime cancer risks for the various exposure scenarios for Swale Area media are presented below. Note that combined risks from dermal contact, incidental ingestion, and ambient air inhalation exposure are presented for soil.

5.5.3.1 WEST SWALE AREA

The non-cancer hazard calculations and calculated lifetime cancer risks for receptors in the West Swale Area are presented in Appendix I and summarized below:

Medium	*Receptor*	*Route*	*Exposure*	*Non-Carcinogenic Hazard Index*	*HI >1.0*	*Carcinogenic Risk*	*Risk $>10^{-6}$*	*Risk $>10^{-4}$*	*Appendix I Table Reference*
Surface Soil	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT (1)	NC	NA	1.4E-06	Yes	No	7.1 CT
			CT (2)	NC	NA	1.2E-06	Yes	No	7.1 CT
			RME (1)	NC	NA	4.6E-06	Yes	No	7.1 RME
			RME (2)	NC	NA	4.0E-06	Yes	No	7.1 RME
	Industrial Worker (Current/ Future)	Ingestion Dermal Inhalation	CT (1)	NC	NA	1.2E-05	Yes	No	7.2 CT
			CT (2)	NC	NA	1.1E-05	Yes	No	7.2 CT
			RME (1)	NC	NA	8.3E-05	Yes	No	7.2 RME
			RME (2)	NC	NA	7.2E-05	Yes	No	7.2. RME
Soil	Construction Worker (Future)	Ingestion Dermal Inhalation	CT (1)	NC	NA	3.3E-07	No	No	7.3 CT
			CT (2)	NC	NA	2.3E-07	No	No	7.3 CT
			RME (1)	NC	NA	1.6E-06	Yes	No	7.3 RME
			RME (2)	NC	NA	1.2E-06	Yes	No	7.3 RME

Notes:

(1) The non-carcinogenic hazard index and carcinogenic risk are based on the Aroclors results.
(2) The non-carcinogenic hazard index and carcinogenic risk are based on the Total PCB results.
NC = Not Calculated
NA = Not Applicable

5.5.3.2 EAST SWALE AREA

The non-cancer hazard calculations and calculated lifetime cancer risks for receptors in the East Swale Area are presented in Appendix I and summarized below:

Medium	*Receptor*	*Route*	*Exposure*	*Non-Carcinogenic Hazard Index*	*HI >1.0*	*Carcinogenic Risk*	*Risk >10^{-6}*	*Risk >10^{-4}*	*Appendix I Table Reference*
Surface Soil	Trespasser (Current/ Future)	Ingestion Dermal Inhalation	CT (1)	3.6E-04	No	1.1E-06	Yes	No	7.4 CT
			CT (2)	NC	NA	9.4E-07	No	No	7.4 CT
			RME (1)	1.2E-03	No	3.7E-06	Yes	No	7.4 RME
			RME (2)	NC	NA	3.1E-06	Yes	No	7.4 RME
	Industrial Worker (Current/ Future)	Ingestion Dermal Inhalation	CT (1)	6.0E-04	No	1.7E-06	Yes	No	7.5 CT
			CT (2)	NC	NA	1.4e-06	Yes	No	7.5 CT
			RME (1)	1.4E-03	No	1.1E-05	Yes	No	7.5 RME
			RME (2)	NC	NA	9.4E-06	Yes	No	7.5 RME
Soil	Construction Worker (Future)	Ingestion Dermal Inhalation	CT (1)	5.9E-02	No	2.8E-07	No	No	7.6 CT
			CT (2)	NC	NA	2.2E-07	No	No	7.6 CT
			RME (1)	3.0E-01	No	1.4E-06	Yes	No	7.6 RME
			RME (2)	NC	NA	1.1E-06	Yes	No	7.6 RME

Notes:

(1) The non-carcinogenic hazard index and carcinogenic risk are based on the Aroclors results.
(2) The non-carcinogenic hazard index and carcinogenic risk are based on the Total PCB results.
NC = Not Calculated
NA = Not Applicable

5.5.4 SUMMATION OF RISKS

A given population may be exposed to a chemical from several exposure routes and from more than one medium. The purpose of this section is to identify the risks associated with a population that may be exposed to COPCs through a combination of exposure pathways.

U.S. EPA (1989) states that risks should be combined across exposure pathways only where the following occurs:

a) reasonable exposure pathway combinations are identified

b) it appears likely that the same individuals would consistently face the "reasonable maximum exposure" ("RME") by more than one pathway

As opposed to encouraging the calculation of combined risks from across exposure pathways, U.S. EPA (1989) cautions that each RME estimate includes many conservative assumptions and combining estimates is not appropriate unless the combination itself is an RME:

> *"For real world situations in which contaminant concentrations vary over time and space, the same individual may or may not experience the RME for more than one pathway over the same period of time. One individual might face the RME through one pathway, and a different individual face the RME through a different pathway. <u>Only if you can explain why the key RME assumptions for more than one pathway apply to the same individual or sub-population should the RME risks for more than one pathway be combined</u>.*
>
> *In some situations, it may be appropriate to combine one pathway's RME risks with other pathways' risk estimates that have been derived <u>from more typical exposure</u> parameter values". (Emphasis added).*

It is improbable that the same person would experience all potential exposures the same number of times or over the period of years specified in the individual RME scenarios. As a result, it may be inappropriate to add together the estimated risks and hazards for the different exposure routes and pathways because this could result in the exaggeration of an appropriate RME for the summed exposures. The summation of the CT estimates may be the more appropriate representation of a cumulative RME. To maintain a conservative approach, RME risk and hazard for separate exposure routes were combined to estimate total RME exposures for the same exposure scenario. Therefore, it is unlikely the summation of the RME estimates would result in an underestimation of risk, and this estimate should be evaluated as a conservative estimate of the potential exposures.

However, it would be inappropriate to sum the exposures that were evaluated separately for the exposed populations in the Swale Area without accounting for the percentage of time a receptor would spend in one area versus the other. The exposure scenarios evaluated in the HHRA assumed that the receptor spent 100 percent of the time in the exposure area being considered in order to receive the chemical dose. Thus, the risks and hazards estimated separately for a receptor group (i.e., trespasser, industrial worker, and construction worker) in the two Swale Areas are not considered additive. The following combined exposure scenarios were considered:

5.5.4.1 WEST SWALE AREA

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in the West Swale Area are presented in Appendix I and summarized below:

Receptor	*Media*	*Exposure*	*Non-Carcinogenic Hazard Index*	*HI >1.0*	*Carcinogenic Risk*	*Risk >10⁻⁶*	*Risk >10⁻⁴*	*Appendix I Table Reference*
Trespasser (Current/ Future)	Surface Soil	CT (1)	NC	NA	1.4E-06	Yes	No	9.1 CT
		CT (2)	NC	NA	1.2E-06	Yes	No	9.1 CT
		RME (1)	NC	NA	4.6E-06	Yes	No	9.1 RME
		RME (2)	NC	NA	4.0E-06	Yes	No	9.1 RME
Industrial Worker (Current/ Future)	Surface Soil	CT (1)	NC	NA	1.2E-06	Yes	No	9.2 CT
		CT (2)	NC	NA	1.1E-05	Yes	No	9.2 CT
		RME (1)	NC	NA	8.3E-05	Yes	No	9.2 RME
		RME (2)	NC	NA	7.2E-05	Yes	No	9.2 RME
Construction Worker (Future)	Soil	CT (1)	NC	NA	3.3E-07	No	No	9.3 CT
		CT (2)	NC	NA	2.3E-07	No	No	9.3 CT
		RME (1)	NC	NA	1.6E-06	Yes	No	9.3 RME
		RME (2)	NC	NA	1.2E-06	Yes	No	9.3 RME

Notes:

(1) The non-carcinogenic hazard index and carcinogenic risk are based on the Aroclors results.
(2) The non-carcinogenic hazard index and carcinogenic risk are based on the Total PCB results.
NC = Not Calculated
NA = Not Applicable

5.5.4.2 EAST SWALE AREA

The cumulative HIs and lifetime cancer risks across all applicable exposure routes for receptors in the East Swale Area are presented in Appendix I and summarized below:

Receptor	*Media*	*Exposure*	*Non-Carcinogenic Hazard Index*	*HI >1.0*	*Carcinogenic Risk*	*Risk >10⁻⁶*	*Risk >10⁻⁴*	*Appendix I Table Reference*
Trespasser (Current/ Future)	Surface Soil	CT (1)	3.6E-04	No	1.1E-01	Yes	No	9.4 CT
		CT (2)	NC	NA	9.4E-07	No	No	9.4 CT
		RME (1)	1.2E-03	No	3.7E-06	Yes	No	9.4 RME
		RME (2)	NC	NA	3.1E-06	Yes	No	9.4 RME
Industrial/ Commercial Worker (Current/ Future)	Surface Soil	CT (1)	6.0E-04	No	1.7E-06	Yes	No	9.5 CT
		CT (2)	NC	NA	1.4E-06	Yes	No	9.5 CT
		RME (1)	1.4E-03	No	1.1E-05	Yes	No	9.5 RME
		RME (2)	NC	NA	9.4E-06	Yes	No	9.5 RME
Construction Worker (Future)	Soil	CT (1)	5.9E-02	No	2.8E-07	No	No	9.6 CT
		CT (2)	NC	NA	2.2E-07	No	No	9.6 CT
		RME (1)	3.0E-01	No	1.4E-06	Yes	No	9.6 RME
		RME (2)	NC	NA	1.1E-06	Yes	No	9.6 RME

Notes:

(1) The non-carcinogenic hazard index and carcinogenic risk are based on the Aroclors results.
(2) The non-carcinogenic hazard index and carcinogenic risk are based on the Total PCB results.
NC = Not Calculated
NA = Not Applicable

Table 10.0 of Appendix I presents a summary of the total combined risks and hazards estimated for all exposure scenarios evaluated in the HHRA.

5.5.5 IDENTIFICATION OF UNCERTAINTIES

The purpose of this Section is to provide a summary evaluation and discussion regarding the uncertainties associated with the final characterization of risk for the Swale Area. Uncertainties identified in the HHRA are discussed below.

5.5.5.1 EXPOSURE SCENARIO ASSUMPTIONS

There is often a degree of uncertainty involved with any evaluation where multiple assumptions are made. Because the assumptions used in some of the exposure scenarios evaluated are not based on objective test data but are subjective estimates based on judgment and experience applied to the data available, the tendency is to select conservative, health-protective values to guard against under-estimating exposure (and associated risk). This approach leads to a general over-estimate in all assumptions. When more than one over-estimate of individual assumptions are included in the scenario equations this exaggerates the over-estimation of each assumption and overstates the total exposure to an even greater degree. The exposure scenarios are therefore conservative in nature to provide a factor of safety that is protective of health.

The intent of this HHRA was to estimate the potential exposure point intakes for both the "average" (CT) and the "RME" scenarios. In order to accomplish this goal, a series of standardized U.S. EPA exposure assumptions were utilized, where available. In the absence of available U.S. EPA guidance on exposure assumptions, professional judgment was used to establish necessary assumptions which are protective of human health.

The CT exposure scenario represents the "average" exposure scenario that may reasonably be expected to occur. The RME exposure scenario represents the reasonable maximum exposure expected to occur. The RME exposure scenario presented in this RA was developed in accordance with the U.S. EPA guidance. The exposure scenarios (CT and RME) were developed to represent reasonable exposures, which may occur under both current and future land use conditions. For the CT exposure scenarios, the CT EPC was the same as the RME EPC rather than the average or mean value for all exposure media. This will result in an overestimation of the risks and hazards for the CT exposure scenarios.

The major uncertainties utilized in the HHRA regarding the physical exposure scenarios are summarized as follows:

- The actual exposure frequency or exposure time of potential industrial workers, construction workers, and trespassers in either Swale Area is unknown. As a result, professional judgment was used to conservatively estimate an RME exposure scenario for the construction worker and trespasser. Guidance presented in the U.S. EPA Disposal of Polychlorinated Biphenyls (PCBs); Final Rule on low occupancy exposure areas was applied in the derivation of the industrial worker exposure scenario in the East Swale Area.
- The utilization of present exposure point concentrations for future exposure scenarios is conservative due to the fact that source material is not being added to the areas of concern and that the levels of PCBs in the soils may decrease with time through natural processes such as biodegradation. The use of steady-state contaminant concentrations generally overestimates future exposures.

- It is assumed that orally ingested chemicals are 100 percent absorbed into the body. Actual absorption rates for ingested contaminants may vary from 5 to 100 percent. Therefore, assuming 100 percent absorption of ingested contaminants may overestimate the associated risks.
- It is assumed that trespassers will spend 100 percent of their time in either one of the exposure areas and will receive all of their potential PCB intake from this area. This is a conservative assumption because the West and East Swale Areas comprise such small percentages of the total plant property. It is more reasonable to assume that a trespasser would spend equal amounts of time in all areas of the plant property.

5.5.5.2 DOSE RESPONSE

One of the major uncertainties in the quantification of risk involves the application of toxicity information. Examples of the uncertainties associated with the toxicity values are presented as follows:

- CSFs are derived from study data on animals dosed with high concentrations and therefore may not be applicable to evaluation of low concentration exposures. High levels of chemicals may override the detoxification or excretion capabilities and allow the chemical to impact the target cells;
- CSFs are developed in a conservative manner. The model used by U.S. EPA makes a number of conservative assumptions which may over estimate carcinogenic potency by several orders of magnitude;
- RfDs are also established with conservative factors of safety in comparison to actual studies, which may be in error. For example, it is assumed that all chemicals are more toxic for man than the test animals studied while the opposite may be true; and
- Non-cancer toxicity data is not available for the majority of PCB Aroclors and total PCBs evaluated in the HHRA. Thus, there is an unknown degree of uncertainty associated with the non-cancer hazard estimates for all of the evaluated exposure scenarios.

5.5.5.3 THE THEORETICAL NATURE OF RISK ESTIMATES

As indicated previously, the results of a health risk assessment assign a numerical value to the probability that a receptor group will develop an additional case of cancer due to the exposure to a specific amount of chemical which is a known or suspect carcinogen. This numerical value is presented as an upper limit excess cancer risk such as 1.0E-06, or one additional cancer case in a million people exposed to the designated chemical concentration for the exposure duration averaged over their entire lifetime. The models that are applied to calculate the numerical risk values typically reflect the uncertainty associated with the data sets used to estimate the slope factors so the true value could be lower. The Cancer Risk Model and the assumptions used to estimate exposure are considered protective of the most sensitive sub-populations, such as children.

6.0 ECOLOGICAL RISK EVALUATION

The PCBs in soils within the Swale Area were evaluated with respect to their potential to generate a risk or threat to ecological receptors. The exposure pathways to these ecological receptors were evaluated with respect to the conditions at the Swale Area. This evaluation was performed within the guidance provided by 40 CFR Part 761 (Rule).

Although potential ecological risks are not explicitly mentioned by the Rule, it does address them implicitly. The ruling states that its default clean-up levels are not intended for PCB releases to habitats typically considered to be public wildlife resources areas (e.g., surface water, sediments). The Rule also states that more stringent clean-up levels could be required if the PCB contamination is too close to important ecological resources, such as "endangered species habitats, estuaries, wetlands, national parks, national wildlife refuges, commercial fisheries, and sport fisheries." Finally, with respect to areas that are currently low occupancy, the Rule states that more stringent high occupancy clean-up levels should be applied if an expected land-use could reasonably be expected to increase the "exposure of people or **animal life**" [bolding added for emphasis]. Thus, the Rule implicitly requires that the potential for ecological risks should be considered before it is applied. As such, a screening level ecological risk evaluation is presented herein for the Swale Area. This evaluation focused on the pathways for exposure.

The available information suggests that there is no significant ecological risk. First, the Swale Area is a small area (about 13 acres) of disturbed land on a working industrial facility. Wildlife use and potential exposure thus will be limited by the small size, poor habitat, and ongoing human disturbance. Second, higher PCB concentrations in the Swale Area occur primarily below the soil surface. In contrast, ecological receptors are generally exposed to the top foot or less of soil, so most of the elevated concentrations of PCBs are well below soil strata to which ecological receptors would be exposed. Similarly, contamination in deeper soils does not represent a significant risk to off-site resources, since deeper strata are less likely to erode. Thus, exposure pathways between ecological receptors and PCBs are currently very limited, and these are functionally incomplete pathways.

Exposure pathways to off-site ecological receptors are also functionally incomplete. The Illinois River, located approximately 1,800 feet south of the Swale Area, contains sports fisheries. The PCBs are contained in soil within the Swale Area are unlikely to migrate to the Illinois River. PCBs are sparingly soluble and very particle-reactive; consequently, they do not migrate efficiently via groundwater, as is evident by the groundwater data. Consistent with this general Rule, no PCBs were detected in samples of groundwater in the Swale Area. Groundwater movement of PCBs is further limited by various clay layers and aquitards surrounding the PCB-contaminated waste.

The Swale Area is relatively flat and enclosed so it is unlikely that the soil particles will travel to the Illinois River or Little LaMarsh Creek (located over 500 feet west of the East Swale Area) by erosion. Additionally, as shown in the Flood Insurance Rate Map presented on Figure 6.1, the Swale Area is mapped in Zone C, an area of minimal flood hazard above the 500-year flood level. The Swale Area is located outside the flood plain associated with the Illinois River (mapped as Zone A13 on Figure 6.1). The absence of migration by groundwater and minimal potential for erosion transport and flooding demonstrate that the exposure pathways from the Swale Area to the Illinois River are effectively incomplete.

The results of this ecological screening evaluation indicated that the exposure pathways from PCBs in the Swale Area are functionally incomplete for ecological receptors.

7.0 FATE AND TRANSPORT

7.1 GENERAL

Properties which affect chemical mobility include, but are not limited to, aqueous solubility, liquid density, vapor pressure, and chemical affinity. The partitioning of chemicals between media is controlled by a variety of factors such as adsorption, absorption, volatilization, solubility, and chemical affinity. PCBs are a group of chemicals comprised of 209 individual compounds (known as congeners). PCBs are chlorinated biphenyls (phenols containing a hydroxyl group bonded directly to the benzene ring) with varying degrees of chloride ion substitution on the benzene ring. PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids.

Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes, and carbonless copy paper; and in many other applications. More than 1.5 billion pounds of PCBs were manufactured in the United States prior to cessation of production in 1977.[12] PCBs are most commonly known by the trade name "Aroclor", which was formerly produced by Monsanto Corporation. However, there were other manufacturers of PCBs. Aroclors were PCB mixtures sold according to their relative chlorine content by weight percent. Each of the Aroclors is comprised of many PCB congeners (biphenyl, chlorobiphenyls, dichlorobiphenyls, trichlorobiphenyls, tetrachlorobiphenyls, etc.). However, the mixtures were adjusted to produce the desired chemical/physical properties for their intended use. A summary of the most common Aroclors is provided below.

Aroclor 1016: A mixture of PCBs containing approximately 41 percent chlorine by weight, Aroclor 1016 is a viscous, oily, light yellow liquid or white powder with a weak hydrocarbon odor. It was most commonly used as an insulator fluid for electrical condensers and as an additive in high-pressure lubricants.

Aroclor 1221: A mixture of PCBs containing 21 percent chlorine by weight, Aroclor 1221 is a viscous, oily, colorless to light yellow liquid with a weak odor. Aroclor 1221 was used as an insulator fluid for electrical condensers, an additive for very high pressure fluids, a plasticizer, an additive in epoxy resins to approve adhesion and resistance to chemical attack, and an additive in polyvinyl acetate.

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[12] U.S. Environmental Protection Agency, Office of Water, Technical Factsheet on Polychlorinated Biphenyls (PCBs), http://www.epa.gov/OGWDW/dwt/t-soc/pcbs.html, January 27, 1998

Aroclor 1232: A mixture of PCBs containing 32 percent chlorine by weight, Aroclor 1232 is a viscous, oily, nearly colorless light yellow liquid with a weak hydrocarbon odor. Aroclor 1232 was used as an additive in polyvinyl acetate, an insulator fluid for electrical condensers, and an additive in very high-pressure lubricants.

Aroclor 1242: A mixture of PCBs containing 42 percent chlorine by weight, Aroclor 1242 is a viscous, oily, nearly colorless to light yellow liquid with a weak hydrocarbon odor. Aroclor 1242 was used in dielectric liquids, in heat-transfer fluids widely used in transformers, in lubricants, as an additive in polyvinyl acetate, and as a plasticizer.

Aroclor 1248: A mixture of PCBs containing 48 percent chlorine by weight, Aroclor 1248 is a viscous, oily, light yellow liquid with a weak hydrocarbon odor. Aroclor 1248 was used as an additive in polyvinyl acetate, an insulator fluid for electrical condensers, and an additive in very high-pressure lubricants.

Aroclor 1254: A mixture of PCBs containing 54 percent chlorine by weight, Aroclor 1254 is a viscous, oily, light yellow liquid with a weak hydrocarbon odor. Aroclor 1254 was used as a secondary plasticizer for polyvinyl chloride (PVC) and as co-polymers of styrene-butadiene and chlorinated rubber.

Aroclor 1260: A mixture of PCBs containing 60 percent chlorine by weight, Aroclor 1260 is a light yellow, sticky, soft resin with a weak hydrocarbon odor. Aroclor 1260 was used as a secondary plasticizer for PVC, an additive in polyester resins and varnish formulations, an insulator fluid for electrical condensers, and an additive for very high-pressure lubricants.

7.2 ENVIRONMENTAL FATE

PCBs are mixtures of different congeners of chlorinated biphenyl, and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In general, the persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di- and trichlorinated biphenyls biodegrade relatively rapidly, tetrachlorinated biphenyls biodegrade slowly, and more highly chlorinated biphenyls are resistant to biodegradation. Although biodegradation of higher chlorinated congeners may occur very slowly on an environmental basis, no other degradation mechanisms have been shown to be important in natural water and soil systems; therefore, biodegradation may be the ultimate degradation process in water and soil.

If released to soil, PCBs experience tight adsorption to organic carbon with that adsorption generally increasing with the degree of chlorination of the PCB. PCBs will generally not leach significantly in aqueous soil systems; the higher chlorinated congeners will have a lower tendency to leach than the lower chlorinated congeners. However, in the presence of organic solvents (both chlorinated and non-chlorinated), PCBs may leach rapidly through soil. Vapor loss of PCBs from soil surfaces appears to be an important fate mechanism with the rate of volatilization decreasing with increasing chlorination. Although the volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of PCBs. Enrichment of the low-chlorine PCBs occurs in the vapor phase relative to the original Aroclor, with the residual mixture becoming enriched in the PCBs containing high chlorine content as volatilization continues.

If released to water, adsorption to sediment and suspended matter will be an important fate process; PCB concentrations in sediment and suspended matter have been shown to be greater than in the associated water column. The PCB composition in the water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water-soluble PCBs (highest chlorine content) will remain adsorbed. In the absence of adsorption, PCBs volatilize relatively rapidly from water. However, strong PCB adsorption to sediment significantly competes with volatilization, with the higher chlorinated PCBs having longer half-lives than the lower chlorinated PCBs. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of the PCBs.

If released to the atmosphere, PCBs will primarily exist in the vapor phase; the tendency to become associated with the particulate phase will increase as the degree of chlorination of the PCB increases. The dominant atmospheric transformation process is probably the vapor phase reaction with hydroxyl radicals, which have estimated half-lives ranging from 12.9 days for monochlorobiphenyl to 1.31 years for heptachlorobiphenyl. Physical removal of PCBs from the atmosphere, which is very important environmentally, is accomplished by wet and dry deposition.

PCBs have been shown to bioconcentrate significantly in aquatic organisms. Average log bioconcentration factors reported for various congeners in aquatic organisms show increasing accumulation with the more highly chlorinated congeners. The major PCB exposure routes to humans are through food and drinking water, and by inhalation of contaminated air.

7.3 CHEMICAL/PHYSICAL PROPERTIES

The chemical and physical properties of PCBs (CAS Number 1336-36-3) are summarized below. Citations are from U.S. EPA's Technical Factsheet on Polychlorinated Biphenyls (PCBs) unless otherwise noted.[13]

Color/Form/Odor: PCB is generic term for a group of organic chemicals which can be odorless or mildly aromatic solids or oily liquids; available in mixtures containing several PCBs and other organics as well.

Melting Point: 340 to 375 degrees Centigrade (°C)

Octanol/Water Partition (K_{ow}): 2.44 to 6.24[14]

Vapor Pressure at 25°C: 7E-03 millimeters of mercury (mmHg) for low chlorine congeners to 1.305EE-12 mmHg for high chlorine congeners

Density/Specific Gravity: 1.44 at 30°C

Solubility: Not applicable; insoluble in water

Octanol/Water Partition Coefficient (log K_{oc}): 2.8 (low chlorine content congeners) to 6.94 (high chlorine content congeners).

Bioconcentration Factor (Log BCF): 3.26 to 5.27 in aquatic organisms; expected to bioconcentrate in aquatic organisms.

Henry's Law Coefficient: 3.3E-04 to 5E-05 atmosphere cubic meters/mole at 20°C.

[13] U.S. Environmental Protection Agency, Office of Water, January 27, 1998.
[14] Montgomery, J. H., Groundwater Chemicals Desk Reference, Second Edition, Boca Raton, Florida, CRC Press, Inc./Lewis Publishers, 1996, pp 814-835.

8.0 REMEDIAL ACTION GOALS AND OBJECTIVES

8.1 OVERVIEW

This section established the remedial action goals and objectives that were later used to assess and compare various remedial actions and their technologies.

The general objective of a Feasibility Study is to develop a remedy which:

- protects public health and the environment;
- satisfies applicable or relevant and appropriate requirements (ARARs);
- provides practical, cost-effective remediation; and
- utilizes permanent remedies which are completed in a short time frame, where applicable.

Remedial action objectives are established under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 (Cleanup Standards) as amended by the Superfund Amendment and Reauthorization Act (SARA). Remedial actions are developed in accordance with the requirements of CERCLA Section 121 and, to the greatest extent practicable, with the NCP as codified in 40 CFR Part 300. As stated in the NCP under Section 300.68(i), remedies selected shall be cost effective and shall effectively mitigate and minimize threats to, and provide adequate protection of, public health and welfare and the environment. SARA expanded the statutory scope of CERCLA and codified requirements, which, before the enactment of SARA, were essentially non-promulgated U.S. EPA policies.

Additional requirements under CERCLA as amended by SARA include the following.

- Preference is to be given to the selection of remedial actions "in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants is a principal element" [SARA, Section 121(b)] (Where permanent remedies involving treatment or recovery technologies are not to be considered, such decisions shall be supported by appropriate explanations).
- Remedial actions "shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment" [SARA Section 121(d)].

- "With respect to any hazardous substances, pollutant, or contaminant that will remain on site" that the residual levels will attain "any standard, requirement, criteria, or limitation under any Federal environmental law" and "any promulgated standard, requirement, criteria, or limitation under a State environmental or facility citing law that is more stringent than the Federal requirements where such goals are relevant and appropriate" [SARA Section 121(d)(2)(A)].

The Federal and State requirements referred to above are collectively referred to as ARARs and are discussed later in this section. Guidelines for the determination of ARARs that may have to be considered during the FS are presented in the U.S. EPA documents entitled:

1. CERCLA Compliance with Other Laws Manual, August 1988
2. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, October 1988

8.2 PRELIMINARY REMEDIATION GOALS

Preliminary remediation goals (PRGs) are established using readily available information such as reference doses, risk-specific doses, or frequently used standards such as ARARs. Selection of PRGs should permit a range of treatment and containment alternatives to be developed. The final acceptable levels should be based upon the results of the baseline HHRA and an evaluation of the expected exposures and associated risks for each alternative.

8.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The potential ARARs are listed in Tables 8.1 through 8.3 and are divided into location-specific, chemical-specific, and action-specific ARARs. Location-specific ARARs are requirements that place restrictions on the implementation of remedial alternatives and the potential impact of the remedial activities would have upon the physical environment (i.e., wetlands, airports, floodplain, etc.). Chemical-specific ARARs are health or risk-based requirements that exclusively pertain to the chemicals of concern. Chemical-specific ARARs may include matrix-specific standards, guidance values, or discharge rates. Action-specific ARARs are technology or activity-based requirements that pertain to the remedial technology to be implemented.

Action-specific ARARs may address material handling, storage, disposal, permitting, and reporting requirements.

Each of the potential remedial alternatives will be screened with respect to the potential ARARs listed in Tables 8.1 through 8.3.

8.4 REMEDIAL ACTION OBJECTIVES

8.4.1 OVERVIEW

The U.S. EPA guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", October 1988, states "specific remedial action objectives consist of medium-specific or operable unit-specific goals for protecting human health and the environment". The objectives must not be so specific that the range of remedial alternatives which can be developed becomes overly limited.

Remedial action objectives established to protect human health and the environment are to specify:

- the chemicals of concern
- the exposure routes and receptors
- an acceptable chemical concentration or range of concentrations for each exposure route

Specifying remedial action objectives in this manner is deemed appropriate since protectiveness may be achieved by reducing exposure to receptors either separately or in conjunction with reducing chemical levels. The guidance further states that "because remedial action objectives for protecting environmental receptors typically seek to preserve or restore a resource, environmental objectives should be addressed in terms of the medium of interest and target cleanup levels, whenever possible". The remedial objectives themselves are not the motivation for initiating a remedial action, but are a set of performance standards against which to compare remedial alternatives.

The HHRA demonstrated that there were no excess cancer risks or hazards associated with the presence of PCBs in the Swale Area based upon the current occupancy levels.

The following significant conclusions were drawn from the HHRA.

West Swale Area (WSA):

1. The HI did not exceed the level of potential concern; and
2. The lifetime excess cancer risks were below to within U.S. EPA's acceptable risk range of 1.0E-06 to 1.0E-04 for the CT and RME for the trespasser, industrial worker, and construction worker exposure scenarios.

East Swale Area (ESA):

1. The HI did not exceed the level of potential concern; and
2. The lifetime excess cancer risks were below to within U.S. EPA's acceptable risk range of 1.0E-06 to 1.0E-04 for the CT and RME for the trespasser, industrial worker, and construction worker exposure scenarios.

8.4.2 REMEDIAL ACTION OBJECTIVES FOR THE SWALE AREA

8.4.2.1 EAST SWALE AREA

The ESA includes land in the vicinity of the former Building Y-12, land in the vicinity of the CILCO substation and south of Buildings P and V, and a portion of the land south of Building R as depicted on Figure 8.1. The ESA meets the criteria for a low occupancy area as described in 40 CFR Part 761.3. However, at a number of locations the PCB concentrations in soil in the ESA were above the 25 mg/kg cleanup level for bulk PCB remediation waste for a low occupancy area as specified at 761.61(a)(4)(i)(B). Therefore, a risk-based closure for the ESA is warranted.

The remedial action objectives identified for the ESA include the following:

1. minimize direct contact to PCBs in soil at concentrations above 25 mg/kg
2. minimize inhalation of soil containing PCBs at concentrations above 25 mg/kg
3. ensure occupancy levels remain at or below the low occupancy level specified at 40 CFR Part 761
4. reduce surface water infiltration through grading and drainage controls

PCBs were not detected in groundwater in the Swale Area. Therefore, no remedial action objectives are necessary for groundwater.

8.4.2.2 WEST SWALE AREA

The WSA includes lands in the vicinity of Building R as depicted on Figure 8.1. In general, due to the presence of plant operations in the area, the WSA does not meet the criteria for a low occupancy area as described in 40 CFR Part 761.3. The PCB concentrations in soil in the WSA are above the 1 mg/kg cleanup level for bulk PCB remediation waste for a high occupancy area as specified at 761.61(a)(4)(i)(A). Therefore, a risk-based closure for the WSA is warranted.

The HHRA concluded that the HI did not exceed the level of potential concern, and the lifetime excess cancer risks were below to within U.S. EPA's acceptable risk range of 1.0E-06 to 1.0E-04 for the CT and RME for the trespasser, industrial worker, and construction worker exposure scenarios.

The remedial action objectives identified for the WSA include the following:

1. minimize direct contact to PCBs in soil at concentrations above 10 mg/kg
2. minimize inhalation of soil containing PCBs at concentrations above 10 mg/kg
3. control worker access to open land east and immediately south of Building R and
4. reduce surface water infiltration through grading and drainage controls

PCBs were not detected in groundwater in the Swale Area. Therefore, no remedial action objectives are necessary for groundwater.

9.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

9.1 GENERAL

Remedial technologies applicable to soil that were identified consistent with the remedial action objectives described in the previous section were screened using the criteria summarized below.

a) Short- and Long-Term Effectiveness

The short-term effectiveness is assessed by its ability to protect human health and the environment during the construction and implementation of a remedy before response objectives are met. The time required to meet these response objectives also factored into this criterion. Long-term effectiveness and permanence are assessed by its ability to maintain the protection of human health and the environment after response objectives have been met. The magnitude of residual risk and adequacy, and reliability of controls are also taken into consideration.

b) Implementability

Under this criterion, a technology is assessed in terms of its technical and administrative feasibility and the availability of required goods and services. Also considered is the reliability of the technology, the ability to monitor the effectiveness of the remedy, and the ease of undertaking additional remedial actions, if necessary.

c) Cost

Under this criterion, a technology is assessed in terms of the relative cost to implement the technology as compared to other applicable remedial technologies.

Remedial technologies applicable to the contaminants and conditions and consistent with the remedial action objectives are identified and screened in this section. Remedial technologies were screened using professional judgment and U.S. EPA guidance documents. Identification and screening of the potential remedial technologies is provided in the following subsections. Table 9.1 presents the results of the screening process. All appropriate technology options are categorized and described by technology type and general response action. Those technologies that were found appropriate have been carried forward for detailed analysis in later sections of this FS. The selected technologies are summarized below.

9.2 NO ACTION

Description

The No Action Alternative allows the Swale Area to exist as is, without implementation of any remedial technologies. There would be no controls on current or future uses. The No Action Alternative is also a requirement for evaluation to serve as a baseline for other alternatives.

Evaluation

The effectiveness of No Action is evaluated, in part, on the basis of whether implementation of other technology options cause greater harm to the public welfare and environment than No Action or provide little benefit relative to their cost.

No costs would be associated with No Action relative to other potentially applicable remedial technologies, and there are no concerns relative to implementability of this remedial technology. This technology would be effective in the short term since the HHRA identified no lifetime excess cancer risk or hazard concerns based upon anticipated exposure scenarios.

The long-term effectiveness of this alternative is suspect due to the absence of controls on future land use. Long-term effectiveness would likely compare favorably with respect to other technologies evaluated assuming current land use and occupancy levels remain at current levels. However, no controls would be established to ensure future occupancy levels remain at acceptable levels.

No Action will be retained as a baseline for evaluating other remedial technologies.

9.3 ADMINISTRATIVE CONTROLS

Administrative controls include:

1. Deed Restrictions
2. Restrictive Ordinances

9.3.1 DEED RESTRICTIONS

Description

Restrictive covenants on deeds on property are intended to prevent or limit unacceptable use and development. Restrictive covenants written into the property deed serve to notify any potential purchaser of the property that potential hazards exist with certain property uses. Restrictive covenants on groundwater usage are intended to prevent or limit the use of the property or certain portions of the property. Restrictive covenants written into the property deed notify any potential purchaser of the property that land use must be restricted and regulated to ensure that there are no health concerns.

This remedial technology involves the legal restriction of future uses of a site. The notice and deed restrictions would mean that any future owner or lessee would have notice of site conditions and could use the land only for non-residential purposes. Specifically, as specified at 40 CFR Part 761.61, the notation on the deed or some other instrument that is normally examined during a title search must be recorded in accordance with state law that will in perpetuity notify any purchaser:

1. that the land has been used for PCB-containing fill
2. of any land-use and occupancy restrictions associated with the final remedy
3. of the existence of a fence or cap and the requirement to maintain the fence or cap
4. of the applicable cleanup levels at the site inside the fence and/or under the cap

In accordance with 40 CFR Part 761.61, a record or notation on the deed of a property must be made within 60 days following completion of remedial activities to address PCB remediation waste.

Evaluation

This technology is effective in the short and long term at controlling property use and maintaining current occupancy levels. These actions effectively minimize future human exposure to PCB-containing soil. Administrative controls can be easily implemented at a low relative cost and are required under the applicable regulations. There are no legal or administrative concerns with implementation of this technology, and this technology is commonly implemented in conjunction with other remedial technologies to form a remedial action.

Administrative controls will be retained for detailed analysis.

9.3.2 RESTRICTIVE ORDINANCES

Description

Local ordinances restricting future land use could prevent or reduce the potential for human contact with the contaminated soil. State or local governments can also implement public education programs. Such programs would be focused on keeping the public aware of both current and future activities and the concerns raised by potential contaminants.

Evaluation

There are no short-term risks associated with implementation of this technology. The property is currently zoned for heavy manufacturing. Therefore, this option would not be effective in the long term at further restricting future land use. This option will not be retained for further evaluation.

9.4 ACCESS CONTROLS

Description

This remedial technology involves measures such as installation of perimeter fencing and signage to restrict physical access to the affected area. In accordance with 40 CFR Part 761.61, a fence and warning sign must be constructed at PCB remediation areas and must remain in place in perpetuity.

Evaluation

Short-term risk to workers is low and can be further reduced through implementation of appropriate health and safety procedures. This technology is effective in the long term at minimizing human exposure to PCB-containing soil and could be easily implemented at a low relative cost. This technology is commonly implemented in conjunction with other technologies to form a remedial action.

This technology will be retained for detailed analysis.

9.5 MONITORING AND MAINTENANCE

Description

Monitoring involves regular inspection of remedial measures implemented at a site. Monitoring also may include collection of soil, sediment, surface water, air, and groundwater samples for analysis. Maintenance includes regular inspection and completing repairs, as necessary, to ensure remedial actions remain effective.

Evaluation

Monitoring and maintenance is frequently used in combination with other remedial technologies. This technology is effective in the short and long term in determining site conditions. There are no concerns with respect to implementability, and relative costs are low to moderate. Short-term risk to site workers is low and can be further reduced through implementation of appropriate health and safety procedures. This technology is frequently implemented in conjunction with other technologies to form a remedial action.

This technology will be retained for detailed analysis.

9.6 CAPPING

Description

This remedial technology involves the design and construction of a cap. The regulation in 40 CFR Part 761.61 defines a cap as a uniform placement of concrete, asphalt, or similar material spread over an area where remediation waste was left in place or removed. A cap constructed of soil must have minimum thickness of 25 centimeters (cm) (10 inches) and a cap constructed of asphalt or concrete must have a minimum thickness of 15 cm (6 inches).

Evaluation

Short-term risk to site workers is low to moderate and can be further reduced through implementation of appropriate health and safety procedures. This technology is effective at minimizing future human exposure to soil and could be easily implemented at a moderate cost.

This technology will be retained for detailed analysis.

9.7 EXCAVATION AND OFF-SITE LANDFILLING

Description

This technology would include excavation of soil impacted by PCBs above a specific concentration and transport of this soil to a permitted TSCA landfill or a RCRA Subtitle D landfill, depending upon the results of soil characterization data. Land disposal does not involve soil treatment but relies on the technologies incorporated in the construction of the landfill to contain the soil and sediment and prevent a future release to the environment. Excavated areas would require backfilling to re-establish grade and positive drainage.

Evaluation

Limitations of this technology include availability of approved disposal space, transportation distance, and cost. Short-term impacts associated with off-site landfilling would include potential worker exposure to PCBs and emissions of fugitive dust during excavation, transportation, and disposal activities. This technology is effective at permanently reducing concentrations of PCBs but the relative cost of this technology is high compared to other technologies identified. Based on the HHRA which indicated that cancer risks and hazards fall within the acceptable range and the lack of exposed ecological receptors, the high costs for this technology are not warranted. Therefore, this technology will not be retained for detailed analysis.

9.8 EXCAVATION AND INCINERATION

Description

This technology would involve excavation of PCB-impacted soil and incineration of the soil either on site or, more likely, at an approved off-site TSCA-permitted incinerator. Incineration is a treatment method for organic compounds which uses high temperature oxidation under controlled conditions to degrade a substance into carbon dioxide, water vapor, sulfur dioxide, nitrogen oxides, hydrogen chloride gases, and ash. The hazardous products of incineration, such as particulates, sulfur dioxide, nitrogen oxides, and hydrogen chloride, require air emission control equipment. When soil is incinerated, there is only a small volume reduction and the byproducts of incineration would then require disposal at a RCRA Subtitle C or Subtitle D landfill, depending on characterization results. Additional concerns with respect to the incineration of organic constituents involve the potential incineration byproducts that may be produced through incomplete combustion as well as the exhaust of particulate containing inorganic constituents.

Evaluation

Incineration is a proven technology that permanently destroys PCBs through thermal treatment. Short-term risk to site workers is moderate to high since this technology would involve excavation and potential worker exposure to PCBs. However, the short-term risks may be managed through implementation of health and safety protocols. The relative costs for incineration are based on unit cost per pound and are very high as compared to other technologies evaluated. Based on the HHRA which indicated that cancer risks and hazards fall within the acceptable range and the lack of exposed ecological receptors, the high costs for this technology are not warranted. Therefore, this technology will not be retained for detailed analysis.

9.9 SOLVENT EXTRACTION/WASHING

Description

Solvent extraction/washing involves removing PCBs from excavated soils and concentrating them in a residual waste stream. The extracted chemicals would require treatment. The solvent often may be recovered by taking advantage of certain properties of the solvent being used. Aliphatic amines (e.g., triethylamine) below 15 ^{o}C can simultaneously solvate oils and water. Above this temperature, water becomes immiscible and separates from the oil and solvent. Consequently, a process can be designed to remove water and organic compounds at low temperatures, separate the water from the organic phase at higher temperatures, and recover most of the solvent through distillation.

A similar process, called critical fluid extraction, involves taking advantage of increased solvent properties of certain gases (e.g., propane or carbon dioxide) when they are compressed to their "critical point". Once the constituents have been extracted, the pressure can be reduced, allowing the solvent to vaporize. The solvent can be recovered and the remaining materials may be used as an industrial fuel or sent to an incinerator or other disposal facility.

Treatability tests run at other sites have indicated that there may be a limit to the reduction of contaminants achievable with these processes under ideal conditions. These tests also indicate this technology is cost effective for soil volumes of 5,000 cubic yards or less. Repeat applications may increase the reductions obtained. However, it may not be cost effective for sites where there are large volumes of material at high concentrations. The application of this technology typically requires a treatability study to determine its suitability.

Evaluation

This technology is more effective on uniform granular soil than on cohesive soil. The technology would permanently reduce PCB concentrations in soil but its effectiveness would need to be determined through treatability testing. Short-term risk to site workers is moderate to high since this technology would involve excavation and potential worker exposure to PCBs. However, the short-term risks may be managed through implementation of health and safety protocols. The relative costs for this technology are very high as compared to other technologies evaluated. Based on the HHRA which indicated that cancer risks and hazards fall within the acceptable range and the lack of exposed ecological receptors, the high costs for this technology are not warranted. Therefore, this technology will not be retained for detailed analysis.

9.10 ON-SITE STABILIZATION

Description

This technology involves mixing of the excavated soil with a fixing agent such as cement rotary kiln dust or fly ash. This technology permanently fixes PCBs in place. Implementation of this technology would include excavation of a limited volume of soil and chemical fixation through mixing in an on-site pug mill. The treated soil would then be replaced in the excavation or placed in a central stockpile. The chemical fixants would immobilize the PCBs.

Evaluation

This technology is very effective at permanently immobilizing PCBs but does not reduce the PCB concentrations in soil except through dilution. This technology has been successfully implemented at other PCB sites. Short-term risk to site workers is moderate to high since this technology would involve excavation and potential worker exposure to PCBs. The relative costs for this technology are very high as compared to other technologies evaluated. Based on the HHRA which indicated that cancer risks and hazards fall within the acceptable range and the lack of exposed ecological receptors, the high costs for this technology are not warranted. Therefore, this technology will not be retained for detailed analysis.

9.11 SUMMARY OF REMEDIAL TECHNOLOGIES

A number of remedial technologies were screened for short- and long-term effectiveness, implementability, and cost. The results of this screening are summarized in Table 9.1.

Remedial Technology	*Retained?*
No Action	Yes
Monitoring	Yes
Deed Restrictions	Yes
Restrictive Ordinances	No
Access Controls	Yes
Capping	Yes
Off-Site Landfilling	No
Incineration	No
Solvent Extraction/Soil Washing	No
On-Site Stabilization	No

The retained technologies will be evaluated in detail in the next section of this report.

10.0 DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

10.1 REMEDIAL OBJECTIVE

The overall remedial objective is to ensure the protection of human health and the environment. The need for remedial action is based on unacceptable health risks and concentrations above chemical-specific ARARs. The U.S. EPA generally considers a site safe when current or future human health carcinogenic risks are between 1×10^{-4} to 1×10^{-6} and a non-carcinogenic hazard index is below the level of concern. If the HHRA does not identify unacceptable human health risks, it is necessary to assess the requirements for remedial action based upon the determination of unacceptable environmental risks or an exceedance of chemical-specific standards.

The HHRA for the study area concluded that the total estimated lifetime cancer risks for all reasonably expected potentially exposed populations fall within or below the U.S. EPA's acceptable target cancer risk range, and the estimated hazard indices are below the level of concern. Therefore, very costly remedies that are not warranted by the risks posed by the Swale Area. This is consistent with U.S. EPA's Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30[15]. However, PCBs are present in soil at concentrations above the objectives promulgated at 40 CFR Part 761.61. Therefore, actions to mitigate potential human exposure to the PCB-containing soil and ensure proper future management of PCB-containing soil are warranted.

10.2 IDENTIFICATION OF SWALE AREA REMEDIAL ALTERNATIVES

The development of Remedial Action Alternatives is based upon combinations of the selected remedial technologies and associated process options required to address the Remedial Action Objectives detailed in the previous section. Specific technology options that survived the initial screening process in Section 9.0 are listed below with their respective technology type. The technology options will be combined to form Remedial Action Alternatives in this section.

As discussed in Section 5.0, the total estimated lifetime cancer risks for all reasonably expected potentially exposed populations fall within or below the acceptable target cancer risk range of 10^{-6} to 10^{-4}, and the estimated hazard indices for all reasonably expected potentially exposed populations are below 1.0. Therefore, remedial

[15] U.S. EPA, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, OSWER Directive 9355.0-30, April 22, 1991.

alternatives were developed to attain the remedial action objective for the Swale Area described in Section 8.4.2.

PCBs were not detected in groundwater in the Swale Area. Therefore, no remedial action objectives are necessary for groundwater.

Potential remedial alternatives for the Swale Area include the following:

- Alternative 1 - No Action (Baseline Alternative)
- Alternative 2 - Partial Capping, Vegetative Cover and Grading Improvements, Deed Restrictions, Access Controls, and Inspection and Maintenance
- Alternative 3 - Capping, Deed Restrictions, Access Controls, and Inspection and Maintenance

10.3 EVALUATION CRITERIA

This section presents an evaluation of the remedial alternatives described in the previous section. Each alternative is evaluated based on the criteria identified below, with the exception of U.S. EPA and community acceptance. The criteria are:

- Overall Protection of Human Health and the Environment: The assessment of this criterion describes how an alternative, as a whole, achieves and maintains protection of human health and the environment. The focus of this criterion is the effectiveness of the alternative to reduce the overall risk to human health or the environment. Overall protection of human health and the environment is referred to as a threshold criterion. An alternative must meet this criterion to be considered for selection.
- Compliance with ARARs: Each alternative is evaluated based on its compliance with ARARs. ARARs may be action, chemical, or location specific and are governed by federal, state, and local laws or ordinances.
- Long-Term Effectiveness and Permanence: Long-term effectiveness is defined as the ability of the alternative to maintain protection of human health and the environment after the response objectives have been met.
- Reduction of Toxicity, Mobility, or Volume of Materials: This criterion is designed to evaluate a remedial alternative based on its effectiveness in reducing the toxic effects, migration potential, and quantity of associated contaminants in order to protect human health and the environment.

- Short-Term Effectiveness: This criterion is designed to assess the protection of human health and the environment during construction and implementation of a remedial alternative prior to meeting the response action objectives.
- Implementability: Each alternative will be assessed with regard to the technical and administrative feasibility of alternatives and the availability of the good or services outlined in the alternatives.
- Cost: The capital cost and annual operation and maintenance costs are provided for comparison of alternatives. Cost estimates are expected to provide an accuracy of -50 to +30 percent. They provide a basis for comparison between alternatives but do not represent exact budget estimates. The cost estimates are based on current price levels and actual costs of similar projects. Engineering costs reflect the costs to complete the design of the various remedial alternatives including the 30 percent, 60 percent, 90 percent, pre-final, and final design submittals, and engineering costs encompass construction oversight and management, project management, inspections, and construction certification.

This remedial alternative evaluation was developed consistent with the NCP to assess any remedial alternative that may be required based on human health risks, environmental risk, or exceedances of chemical-specific standards. This remedial alternative evaluation was conducted in accordance with the U.S. EPA guidance document entitled Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-89/004) dated October 1988.

10.4 ALTERNATIVE 1: NO ACTION

10.4.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 involves no remedial action and, therefore, does not have any direct effects on overall protection of human health or the environment. However, as discussed Section 5.0, the total estimated lifetime cancer risks for all reasonably expected potentially exposed populations fall within the acceptable target cancer risk range of 10^{-4} to 10^{-6}, and the hazard index for all reasonably expected potentially exposed populations was below 1.0, assuming these areas will continue to be in industrial use.

No Action does not provide any access or administrative controls to ensure future industrial/commercial use. Therefore, this remedial alternative is not fully protective of human health. Additionally, PCBs are present in soil at concentrations above the levels regulated under TSCA. This alternative does not provide any controls to ensure proper soil management and handling practices consistent with the Part 761 regulations.

10.4.2 COMPLIANCE WITH ARARs

Alternative 1 would not comply with ARARs.

10.4.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 involves no remedial action and would not be effective in the long term unless current land use and occupancy levels are maintained.

10.4.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Alternative 1 would not reduce the toxicity, mobility, or volume of contaminants through treatment.

10.4.5 SHORT-TERM EFFECTIVENESS

Alternative 1 involves no remedial action and there would be no short-term impacts to construction workers and the community during construction and implementation of this alternative.

10.4.6 IMPLEMENTABILITY

There are no concerns associated with implementation of this technology.

10.4.7 COST

There are no costs associated with implementation of Alternative 1.

10.5 ALTERNATIVE 2: DEED RESTRICTIONS, PARTIAL CAPPING, VEGETATIVE COVER, ACCESS CONTROLS, AND INSPECTION AND MAINTENANCE

Alternative 2 would employ the following technologies:

- capping over a limited area
- grading and vegetative cover improvements
- deed restrictions
- access controls (fencing)
- inspection and maintenance

Capping would occur in the northern portion of the WSA where there is the potential for higher levels of human occupancy. A compacted soil cap would be constructed in accordance with 40 CFR Part 761.61, would mitigate direct contact with surface contamination, and would reduce the volume of infiltration of water through contaminated soils. The compacted soil cap would include reworking and compaction of the upper 4 to 6 inches of the existing soil cover and placement of 6 inches of compacted clean fill from an existing on-site soil stockpile. This would be covered with 4 inches of soil suitable for sustaining a vegetative cover. The access roads and drives in the vicinity of Building R would be upgraded to asphalt or concrete to permit vehicular access and act as a cap.

Regrading and reseeding would establish a robust vegetative cover over the ESA to prevent erosion and transport of contaminated soil. The existing soil would be regraded to promote surface drainage. In addition, a layer of imported topsoil would be placed, as necessary, to promote the growth of a grass vegetative cover to stabilize the soil. The landfill access road in the eastern portion of the ESA would be upgraded with asphalt or concrete to permit vehicular access to the permitted foundry sand landfill to the south. Fencing and signage would be installed around the ESA to reduce potential industrial worker and trespasser access to the area.

Institutional controls in the form of deed restrictions would be used to identify areas where remedial actions were implemented, specify ongoing maintenance of these areas, and identify low occupancy areas (ESA). The deed restrictions would also specify industrial/commercial land use and a groundwater use restriction. A soil management plan would be developed to ensure proper handling of any soil removed from the area in the future. A health and safety plan would be prepared and implemented for work required in these areas to minimize short-term construction worker exposure to PCBs. Finally, an operations and maintenance (O&M) plan would be developed to specify the tasks to be performed to ensure the fence, cap, and vegetative cover areas remain in good repair.

The areas where caps, vegetative covers, and fencing would be installed are depicted on Figure 10.1.

10.5.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The total estimated lifetime cancer risks for all reasonably expected potentially exposed populations fall within the acceptable target cancer risk range of 10^{-4} to 10^{-6}, and the hazard index for all reasonably expected potentially exposed populations was below 1.0, assuming these areas will continue to be in industrial use. This alternative ensures that the PCBs that remain in place above chemical-specific criteria are properly managed. The results of the ecological screening evaluation indicated that the exposure pathways from PCBs in the Swale Area are functionally incomplete for on-site and for off-site ecological receptors. This alternative would meet all established Remedial Action Objectives.

10.5.2 COMPLIANCE WITH ARARs

Alternative 2 would comply with 40 CFR Part 761 upon approval by the U.S. EPA's Regional Administrator.

10.5.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 2 would be effective at reducing human exposure to PCBs in the soil. This would be accomplished through a combination of capping, grading improvements, deed restrictions, access controls, and periodic monitoring and maintenance to ensure the cap, vegetative cover, and perimeter fencing remain in good repair.

10.5.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Alternative 2 would not reduce the toxicity or volume of contaminants through treatment. However, Alternative 2 would reduce the mobility of the contaminants by ensuring an adequate cover is established to minimize potential fugitive dust emissions.

10.5.5 SHORT-TERM EFFECTIVENESS

Potential short-term impacts posed by this alternative would be caused by fugitive dust emissions during upgrade of the vegetative cover and installation of the perimeter fence. However, these emissions would be minimized by implementation of appropriate dust control measures and decontamination procedures and establishment of proper work zones during construction activities. Construction workers would be protected through implementation of appropriate health and safety procedures.

10.5.6 IMPLEMENTABILITY

There are no concerns associated with implementation of this technology.

10.5.7 COST

The capping and vegetative cover improvements are depicted on Figure 10.1. The area to be capped encompasses approximately 3.2 acres and the area of grading/vegetative cover improvements encompasses an area of approximately 9.3 acres. The cost of Alternative 2 is summarized in Table 10.1. The present worth of Alternative 2 based on a 5 percent discount rate over a 30-year period is estimated to be $1,270,000.

Much of the capital costs for this alternative result from improvements to existing features such as roads and other paved surfaces required to access structures and allow business operations to continue. For example, concrete access and turnaround areas would be constructed near Building R2 to allow trucks and equipment ingress and egress to this building. Similarly, an aggregate or asphalt-paved road would be constructed through the ESA to permit access to the active 817 landfill located to the south. These paved surfaces would serve as engineered barriers over PCB-containing soil.

Other costs are tied to demolition work required to complete the cap and vegetative cover. For example, an out-of-service diesel fuel aboveground storage tank (AST) and containment structure located in the southeastern portion of the WSA would be decommissioned as would an out-of-service AST farm located within the proposed vegetative cover area south of Building P. The required improvements are summarized in Table 10.1.

Although rough grading and fill would be completed to improve drainage, no drainage controls would be installed as part of this alternative. Existing drainage patterns would be largely preserved.

10.6 ALTERNATIVE 3: CAPPING, DEED RESTRICTIONS, ACCESS CONTROLS, AND MONITORING AND MAINTENANCE

Alternative 3 would employ the following technologies:

- capping over the entire Swale Area where PCB concentrations in soil exceed 10 mg/kg
- deed restrictions
- access controls (fencing)
- inspection and maintenance

Alternative 3 is substantially similar to Alternative 2 except capping would occur in the portions of the ESA and WSA where PCB concentrations in soil are above 10 mg/kg. A compacted soil cap would be constructed in accordance with 40 CFR Part 761.61, would mitigate direct contact with surface contamination, and would reduce the volume of infiltration of water through contaminated soils. The compacted soil cap would include reworking and compaction of the upper 4 to 6 inches of the existing soil cover and placement of 6 inches of compacted clean fill. This would be covered with 4 inches of soil suitable for sustaining a vegetative cover. The access roads and drives in the vicinity of Building R would be upgraded to asphalt or concrete to permit vehicular access and act as a cap. Fencing would be installed and upgraded in a manner similar to Alternative 2.

Institutional controls in the form of deed restrictions would be used to identify areas where remedial actions were implemented, and specify ongoing maintenance of these areas. The deed restrictions would also specify industrial/commercial land use and a groundwater use restriction. A soil management plan would be developed to ensure proper handling of any soil removed from the area in the future. A health and safety plan would be prepared and implemented for work required in these areas to minimize short-term construction worker exposure to PCBs. Finally, an O&M plan would be developed to specify the tasks to be performed to ensure the fence, cap, and vegetative cover areas remain in good repair.

The areas where and fencing would be installed are depicted on Figure 10.2.

10.6.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The total estimated lifetime cancer risks for all reasonably expected potentially exposed populations fall within the acceptable target cancer risk range of 10^{-4} to 10^{-6}, and the hazard index for all reasonably expected potentially exposed populations was below 1.0, assuming these areas will continue to be in industrial use. This alternative ensures that the PCBs that remain in place above chemical-specific criteria are properly managed. The results of ecological screening evaluation indicated that the exposure pathways from PCBs in the Swale Area are functionally incomplete for ecological receptors. This alternative would meet all of the established Remedial Action Objectives.

10.6.2 COMPLIANCE WITH ARARs

Alternative 3 would comply with 40 CFR Part 761 upon approval by the U.S. EPA's Regional Administrator.

10.6.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 3 would be effective at reducing human exposure to PCBs in the soil. This would be accomplished through a combination of capping, grading improvements, deed restrictions, access controls, and periodic monitoring and maintenance to ensure the cap, vegetative cover, and perimeter fencing remain in good repair.

10.6.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Alternative 3 would not reduce the toxicity or volume of contaminants through treatment. However, Alternative 3 would reduce the mobility of the contaminants by ensuring an adequate cover is established to minimize erosion and transport of soil by wind or water.

10.6.5 SHORT-TERM EFFECTIVENESS

Short-term impacts posed by this alternative would be caused by fugitive dust emissions during construction of the cap and installation of the fence. However, these emissions

11.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

The remedial alternatives were evaluated based on seven of the nine criteria set out in the RI/FS guidance. U.S. EPA and Community Acceptance criteria were not evaluated. Alternative 2 (partial cap/grading improvements) and Alternative 3 (capping) rated favorably in the following criteria:

1. overall protection of human health and the environment
2. compliance with ARARs
3. long-term effectiveness and permanence
4. reduction in the toxicity, mobility or volume of material
5. short-term effectiveness
6. implementability
7. cost

Alternative 1 (No Action) did not comply with the ARARs, did not ensure long-term effectiveness of the remedy, and did not reduce the toxicity, mobility, or volume of waste.

This section evaluates the remedial alternatives against each other relative to the criteria summarized above.

11.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 2 and 3 rated favorably with respect to protection of human health and the environment. Alternatives 2 and 3 address PCB-containing soil through in-place encapsulation and use administrative controls that would also serve to notify future property owners of the presence of a PCB remediation area and the requirements to control access to the area and maintain and repair the cap or vegetative cover area, drainage controls, and fencing and signage.

Although the HHRA indicates no significant excess risk to human health with respect to exposure to PCB-containing soil at current occupancy levels, no administrative or access controls would be employed with Alternative 1 to ensure industrial/commercial land use is maintained or that PCB-containing soil would be properly managed in the future. As such, Alternative 1 is not protective of human health and the environment.

would be minimized by implementation of appropriate dust control measures and decontamination procedures and establishment of proper work zones during construction activities. Construction workers would be protected through implementation of appropriate health and safety procedures.

10.6.6 IMPLEMENTABILITY

There are no concerns associated with implementation of this technology.

10.6.7 COST

The cap would be constructed over the area depicted on Figure 10.2. This area encompasses approximately 13 acres. The cost of Alternative 3 is summarized in Table 10.2. The present cost of Alternative 3 based on a 5 percent discount rate over a 30-year period is estimated to be $1,430,000. Similar to Alternative 2, much of the capital costs for this alternative result from the same improvements described previously, which are necessary to allow business operations to continue and/or to complete construction of the cap. Significant filling and regrading would be conducted to improve drainage in the Swale Area.

Similar to Alternative 2, this alternative ensures that the soil containing PCBs above chemical-specific criteria are properly managed. Therefore, this remedial alternative is fully protective of human health. However, Alternative 3 is more expensive than Alternative 2 but does not provide significantly more protection to human health or the environment because current human health and environmental risk is low.

11.2 COMPLIANCE WITH ARARs

Alternatives 2 and 3 comply with the ARARs and accomplish this through engineering improvements and institutional controls. Alternative 1 does not comply with ARARs since impacted media would remain in place above regulatory levels and no measures would be employed to prevent access to the area.

11.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives 2 and 3 leave the PCB-containing soil in place but use engineering, administrative, and access controls to control human exposure and reduce mobility of PCBs. Inspection and maintenance would ensure these remedies remain effective.

Under Alternative 1, PCB-containing soil would remain in place with no controls to ensure occupancy remains at acceptable levels. Similarly, no access controls would be constructed to limit access to the area.

11.4 REDUCTION IN TOXICITY, MOBILITY, OR VOLUME OF MATERIAL

Alternatives 2 and 3 would result in a reduction in mobility of PCBs through use of a vegetative cover and/or capping to reduce surface exposure, the volume of infiltration through PCB-containing soils, fugitive emissions, and transport of impacted soil through wind and water erosion.

No reduction in the toxicity, mobility, or volume of PCB-containing soil would occur under Alternative 1.

11.5 SHORT-TERM EFFECTIVENESS

None of the alternatives represents a significant risk to the public or workers. Alternative 1 provides the least short-term risk to workers and the public. Due to the construction requirements, Alternatives 2 and 3 pose some short-term risk to site workers due to potential exposure to PCBs but the limited short-term risks that exist for these alternatives could be effectively managed through implementation of health and safety programs.

11.6 IMPLEMENTABILITY

There are no serious concerns regarding the implementability of any of the three alternatives. Alternative 1 is the easiest to implement, followed by Alternatives 2 and 3.

11.7 COST

A summary of the Remedial Action Alternatives in reverse order of cost (most expensive to least expensive) is provided below:

Remedial Alternative Description		*Present Worth Cost*
Alternative 3:	Capping, Deed Restrictions, Access Controls, and Inspection and Maintenance	$1,430,000
Alternative 2:	Partial Capping, Grading Improvements, Deed Restrictions, Access Controls, and Inspection and Maintenance	$1,270,000
Alternative 1:	No Action	$0

Alternatives 2 and 3 provide nearly equivalent levels of protection to human health and the environment. Alternative 2 accomplishes this protection at the lowest cost. Alternative 1 is the lowest cost alternative but does not meet the Remedial Action Alternatives and would not be protective of human health and the environment.

Alternative 2 is the preferred remedial alternative because it provides a similar level of protectiveness to human health and environment at a lower cost than Alternative 3.

12.0 SUMMARY AND CONCLUSIONS

12.1 SOIL AND GROUNDWATER INVESTIGATIONS

Caterpillar operates a gray iron foundry at its Mapleton, Illinois facility that manufactures engine blocks, cylinder heads, liners, and camshafts used in Caterpillar equipment and for sale to other companies. In 1998, Caterpillar initiated a soil investigation in a small portion of the Swale Area where drums containing hazardous wastes were formerly stored in a RCRA Drum Storage Area. During the course of this investigation, PCBs were detected in soil samples although these compounds were not among the chemicals stored in this area. The subsequent soil investigations completed by Caterpillar identified the presence of PCBs in soil within and adjacent to the former RCRA Drum Storage Area. Caterpillar retained CRA to implement a soil and groundwater investigation within and proximal to the area where PCB-containing soil was identified during Caterpillar's investigations.

The two areas investigated include the West Swale Area and the East Swale. Both Swale Areas comprise an area of approximately 13 acres and are bounded to the south and east by the TP&W rail easement, to the west by the road to the pump houses, and to the north by engineered fill and Building B. The investigations were completed, and this report was prepared to obtain approval from the Regional Administrator for a risk-based closure pursuant to 40 CFR Part 761.61(c) (Rule). Investigative activities completed to date were successful in delineating the nature and extent of PCB impacts in the soil Swale Area. In addition to successfully delineating PCB impacts, a thorough understanding of the geology and hydrogeology was obtained during the investigations documented by this report.

Significant findings of the soil and groundwater investigations are provided below.

LAND USE

- Land use south of Highway 24/9, a four lane divided highway, is primarily industrial. The plant property abuts industrial property to the east, and industrial land use extends approximately 2 miles to the east, upstream along the Illinois River.
- North of Highway 24/9, land use is primarily agricultural. The Village of Mapleton, Illinois (population approximately 200) lies across Highways 24/9 from the eastern portion of the plant property. Much of the land immediately north of the plant property is wooded, especially in the deeply incised drainage valleys.
- South of the Illinois River, land use is primarily agricultural.

- Southwest of the plant property and on the opposite side of the Illinois River lies Powerton Lake, a large cooling water reservoir serving the Powerton electrical generating plant which is located southeast of the plant property.
- There are no major population centers within a 3-mile radius of the plant property.

GEOLOGY

- Information on plant property geology compiled during this investigation is supplemented by numerous soil borings advanced during previous investigations.
- Geology beneath the plant property consists of alternating layers of unconsolidated alluvial deposits underlain by shale bedrock of the Pennsylvanian System.
- Unconsolidated alluvial deposits thicken at the plant property as the Illinois River is approached. Near the Illinois River, alternating layers of sand and clay beds are present.
- Beneath the study area, bedrock elevations increase and the top of the bedrock approaches the surface. Clay sand layers pinch out with distance from the Illinois River, and clay soil overlies bedrock.

HYDROGEOLOGY

- Groundwater was encountered within the engineered fill, the underlying native silty clay, and the foundry sand fill in the Swale Area.
- Groundwater investigations and regular monitoring activities conducted in the vicinity of the 817 landfill demonstrate groundwater flow in the alluvial deposits to be consistently southerly, towards the Illinois River.
- Hydraulic conductivity values vary widely based upon the composition of the formations. Sand and gravel deposits exhibit hydraulic conductivity values in the 10^{-2} to 10^{-4} cm/s range, while silt and clay units exhibited hydraulic conductivity values in the 10^{-7} to 10^{-9} cm/s range.
- Groundwater elevation data indicates the presence of a groundwater high (mound) within the Swale Area, suggesting a radial groundwater flow outward from the Swale Area.
- The radial groundwater flow pattern suggests that groundwater flow in the Swale Area is driven by precipitation rather than local or regional gradient effects.
- The magnitude of the groundwater mounding would vary depending upon the amount of precipitation. Most likely, the groundwater mounding effect in the Swale Area is more pronounced during periods of heavier precipitation when groundwater infiltration would be greater.

SOIL ANALYTICAL DATA

Caterpillar Soil Data

- 107 individual soil samples were collected by Caterpillar and submitted for PCB analysis.
- PCBs were detected in 49 of the 53 soil borings and in 106 of the 107 samples analyzed. PCB concentrations ranged from non-detect to a maximum of 340 mg/kg.
- The most elevated PCB detections were noted in the soil samples collected from the foundry sand layer.

Swale Area Soil Analytical Data

- Thirty-six soil borings (B-1 through B-21, B-26, and B-53 through B-66) were advanced in the Swale Area and 145 soil samples were submitted for PCB analyses.
- Total PCB concentrations in the Swale Area ranged from non-detect at many locations/intervals to a maximum of 1,200 mg/kg in the soil sample collected from the 6- to 7-foot interval at soil boring B-56.

Groundwater Analytical Data

- Three groundwater monitoring wells were installed in the Swale Area, and groundwater samples were collected for PCB analysis.
- PCBs were not detected in the groundwater samples collected from the three monitoring wells located within the Swale Area.

12.2 HUMAN HEALTH RISK ASSESSMENT

A HHRA was completed for the two areas that were the focus of this report. The WSA and ESA are the western and eastern portions of the Swale Area, respectively. The HHRA was prepared in accordance with the NCP and applicable U.S. EPA guidance.

The HHRA utilized analytical data generated from investigations including Caterpillar's initial investigation of the former Drum Storage Area and the Swale Area investigation completed by CRA. The data were used to evaluate the potential current and future impact, if any, to human health based on exposure to PCBs identified in the study area. Since the ESA meets the definition of a low occupancy area pursuant to 40 CFR

Part 761.61 of the federal regulations, the exposure levels defined therein were used to calculate potential risk. The WSA was assessed using industrial/commercial exposure assumptions documented in the applicable guidance.

The following significant conclusions were drawn from the HHRA.

West Swale Area (WSA):

1. The HI did not exceed the level of potential concern.
2. The lifetime excess cancer risks were below to within U.S. EPA's acceptable risk range of 1.0E-06 to 1.0E-04 for the CT and RME for the trespasser, industrial worker, and construction worker exposure scenarios.

East Swale Area (ESA):

1. The HI did not exceed the level of potential concern.
2. The lifetime excess cancer risks were below to within U.S. EPA's acceptable risk range of 1.0E-06 to 1.0E-04 for the CT and RME for the trespasser, industrial worker, and construction worker exposure scenarios.

The HHRA demonstrated that there were no excess cancer risks or hazards associated with the presence of PCBs in the Swale Area based upon current occupancy levels. As such, at a minimum, administrative controls are warranted to ensure that current occupancy levels are maintained.

12.3 ECOLOGICAL RISK EVALUATION

A screening level Ecological Risk Evaluation was completed for the Swale Area. This evaluation focused on the potential risk or threat to ecological receptors. The results of this evaluation indicated that the exposure pathways from PCBs in the Swale Area are functionally incomplete for ecological receptors. As such, the current conditions along with remedies contemplated for the Swale Area will ensure that these pathways for ecological exposure remain incomplete.

12.4 FEASIBILITY STUDY

12.4.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives were established for the Swale Area to protect human health and the environment.

REMEDIAL ACTION OBJECTIVES FOR THE SWALE AREA

EAST SWALE AREA (ESA)

The remedial action objectives for the identified for the ESA include the following:

1. minimize direct contact to PCBs in soil at concentrations above 25 mg/kg
2. minimize inhalation of soil containing PCBs at concentrations above 25 mg/kg
3. ensure occupancy levels remain at or below the low occupancy level specified at 40 Code of Federal Regulations (CFR) Part 761
4. reduce surface water infiltration through grading and drainage controls

WEST SWALE AREA (WSA)

The remedial action objectives for the identified for the WSA include the following:

1. minimize direct contact to PCBs in soil at concentrations above 10 mg/kg
2. minimize inhalation of soil containing PCBs at concentrations above 10 mg/kg
3. control worker access to open land east and immediately south of Building R
4. reduce surface water infiltration through grading and drainage controls

PCBs were not detected in groundwater in the Swale Area. Therefore, no remedial action objectives are necessary for groundwater.

12.4.2 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

A number of remedial technologies focused in soils in the Swale Area were screened for short- and long-term effectiveness, implementability, and cost, and the result of this screening is summarized as follows.

Remedial Technology	*Retained?*
No Action	Yes
Monitoring	Yes
Deed Restrictions	Yes
Restrictive Ordinances	No
Access Controls	Yes
Capping	Yes
Off-Site Landfilling	No
Incineration	No
Solvent Extraction/Soil Washing	No
On-Site Stabilization	No

The retained technologies were evaluated in detail and used to develop Remedial Action Alternatives that met the established Remedial Action Objectives.

12.4.3 EVALUATION OF REMEDIAL ACTION ALTERNATIVES

A number of remedial technologies applicable to PCB-containing soil were identified and screened. The following Remedial Action Alternatives were developed for PCB-containing soil using the retained remedial technologies and were evaluated in detail.

Potential remedial alternatives for the Swale Area include the following:

- Alternative 1 - No Action
- Alternative 2 - Partial Capping, Vegetative Cover, Deed Restrictions, Access Controls, and Inspection and Maintenance
- Alternative 3 - Capping, Deed Restrictions, Access Controls, and Inspection and Maintenance

Each of the above-noted alternatives, except Alternative 1 (No Action), would include upgrading and maintaining the fencing surrounding the Swale Area and minor improvements to the existing drainage swale to prevent soil erosion. Deed restrictions and access controls would be established to ensure this Swale Area remains a low occupancy area as defined by 40 CFR Part 761.61.

The remedial alternatives were evaluated based on seven of the nine criteria setout in the RI/FS guidance except that Agency and Community Acceptance criteria were not evaluated. Alternatives 2 and 3 rated favorably in the following criteria:

1. overall protection of human health and the environment
2. compliance with ARARs
3. long-term effectiveness and permanence
4. reduction in the toxicity, mobility or volume of material
5. short-term effectiveness
6. implementability
7. cost

A summary of the Remedial Action Alternatives in reverse order of cost (most expensive to least expensive) is provided below:

Remedial Alternative Description		*Present Worth Cost*
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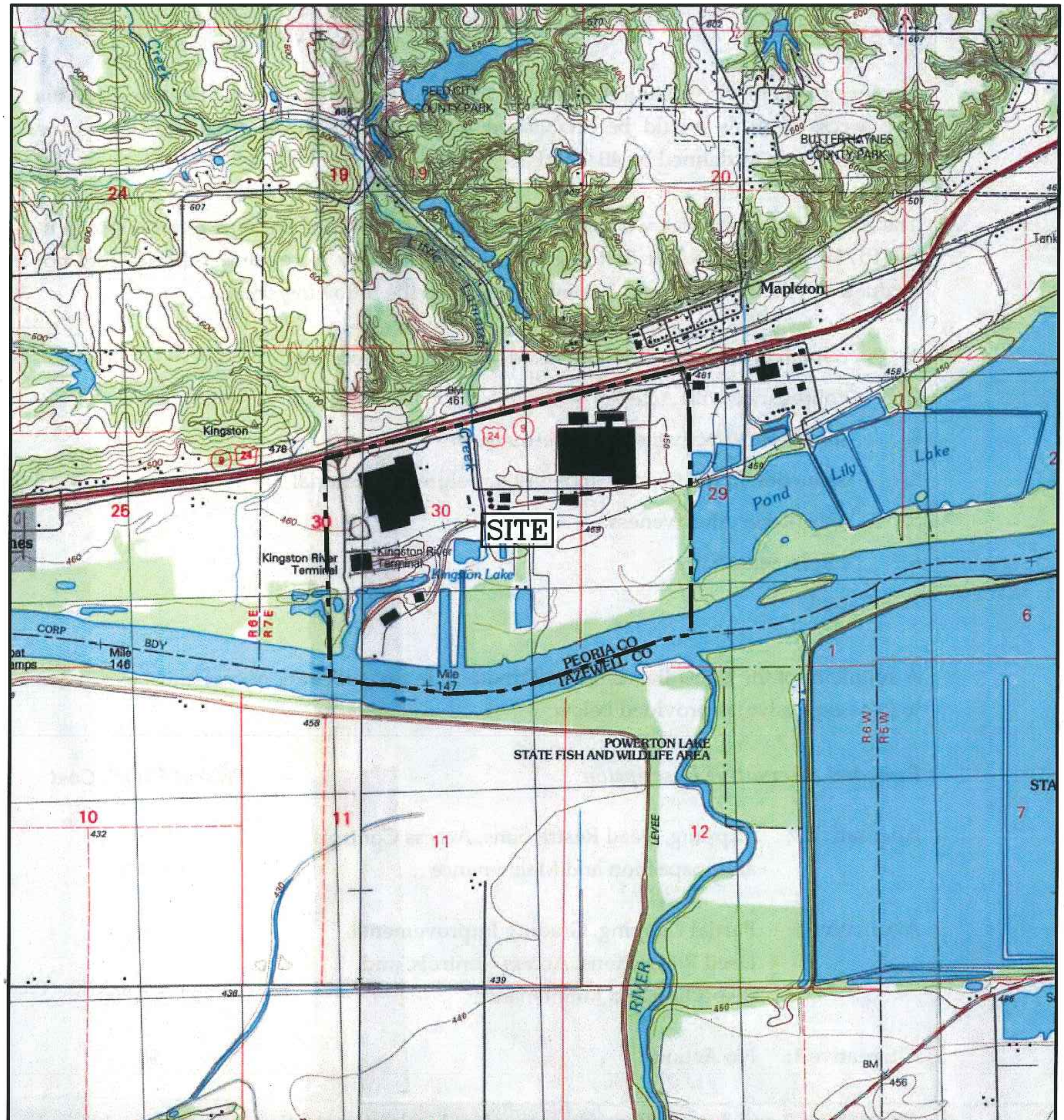
Alternative 2:	Partial Capping, Grading Improvements, Deed Restrictions, Access Controls, and Inspection and Maintenance	$1,270,000
Alternative 1:	No Action	$0

Alternatives 2 and 3 provide nearly equivalent levels of protection to human health and the environment. Alternative 2 accomplishes this protection at the lowest cost. Alternative 1 is the lowest cost alternative but does not meet the Remedial Action Alternatives and would not be protective of human health and the environment.

Alternative 2 is the preferred remedial alternative because it provides a similar level of protectiveness to human health and environment at a lower cost than Alternative 3.



BASE SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE; GLASFORD AND PEKIN, IL 1996

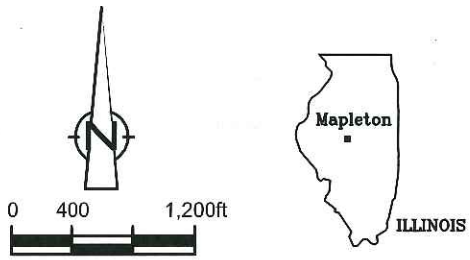


figure 1.1

PLANT LOCATION
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO001 MAY 03/2010

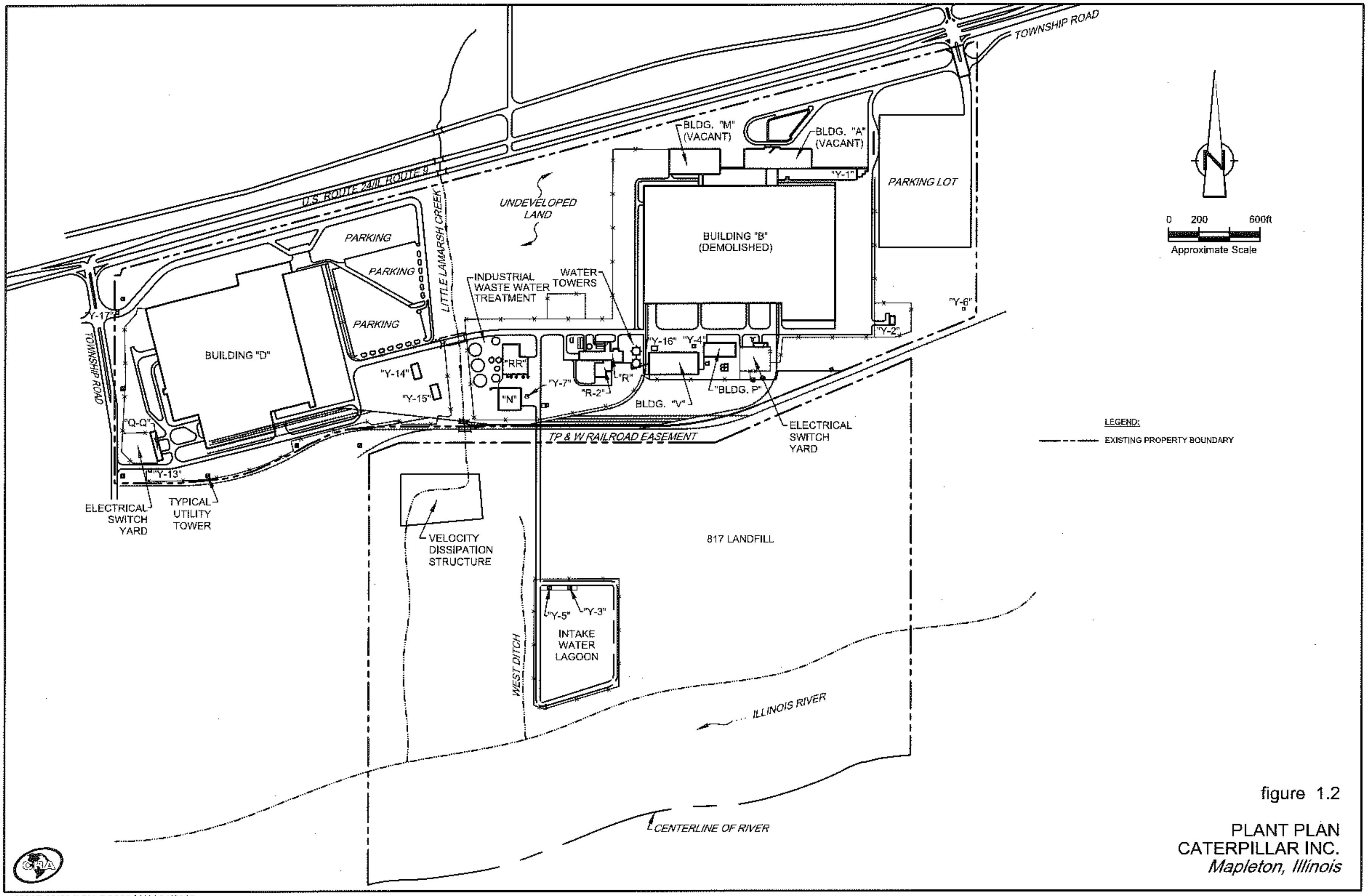


figure 1.2

PLANT PLAN
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO002 MAY 04/2010

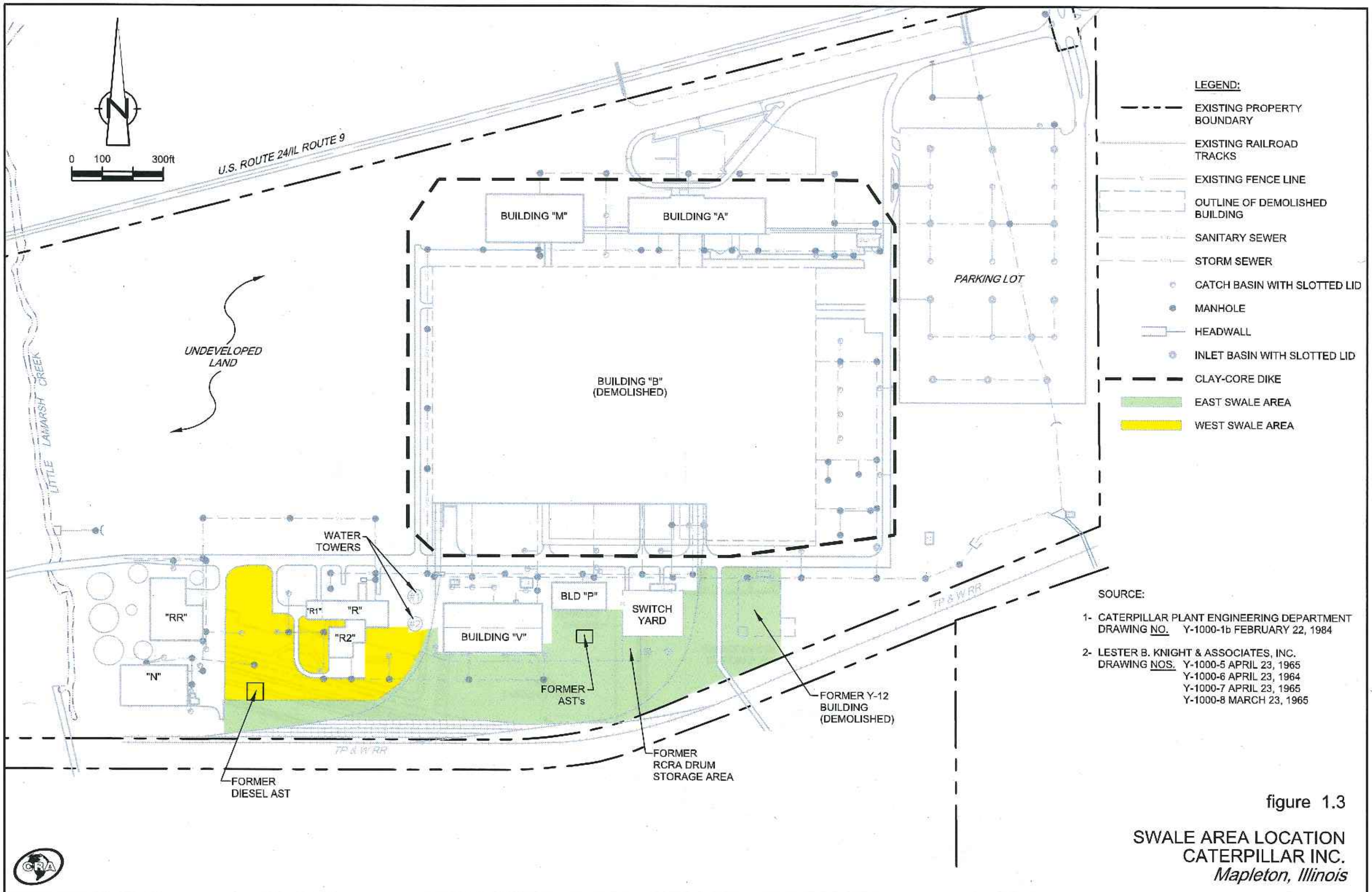
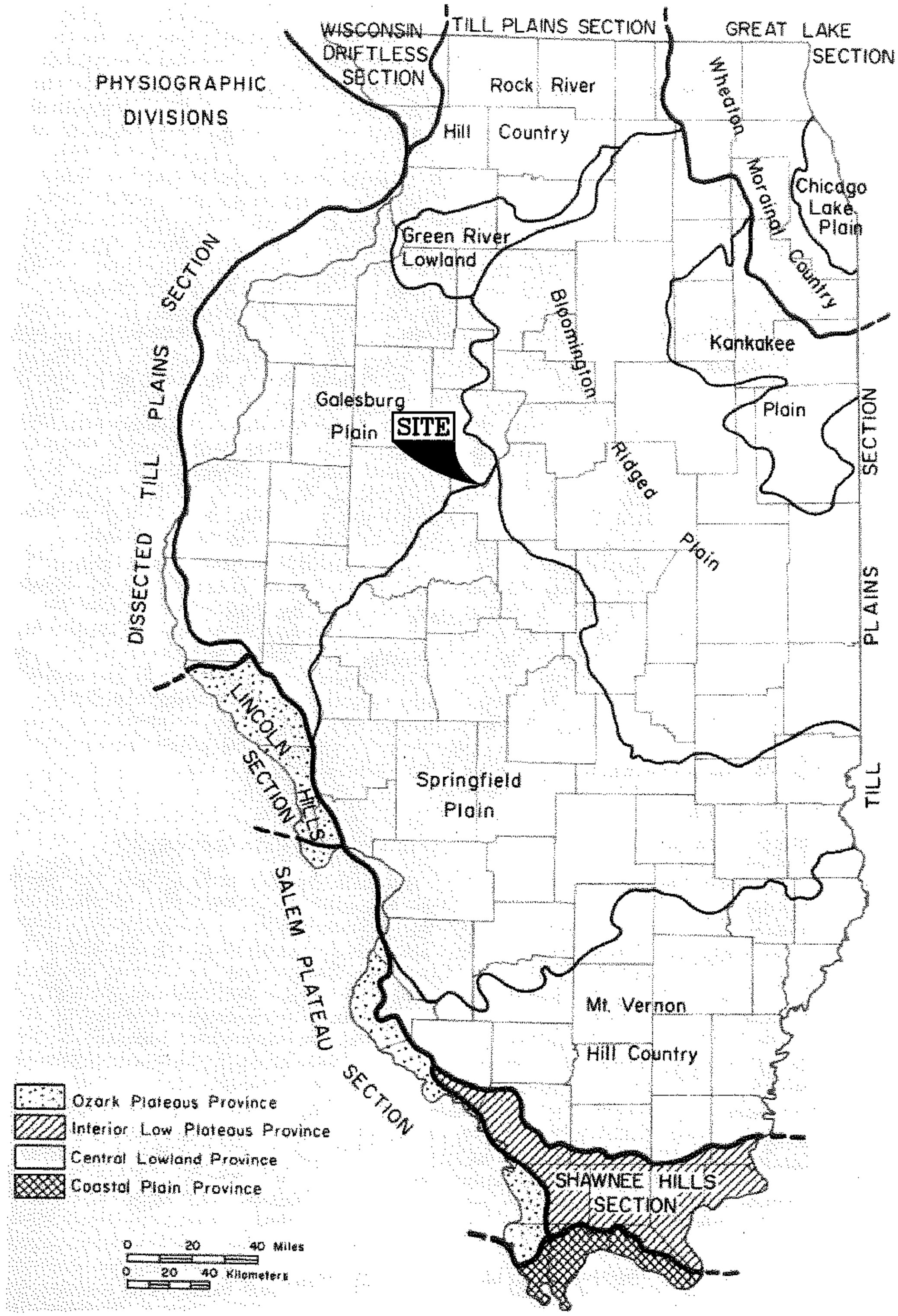


figure 1.3

SWALE AREA LOCATION
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO003 MAY 04/2010



SOURCE: ILLINOIS STATE GEOLOGICAL SURVEY DEPARTMENT OF REGISTRATION AND EDUCATION BULLETIN 95, 1975

figure 2.1

PHYSIOGRAPHIC DIVISIONS OF ILLINOIS
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO004 MAY 04/2010

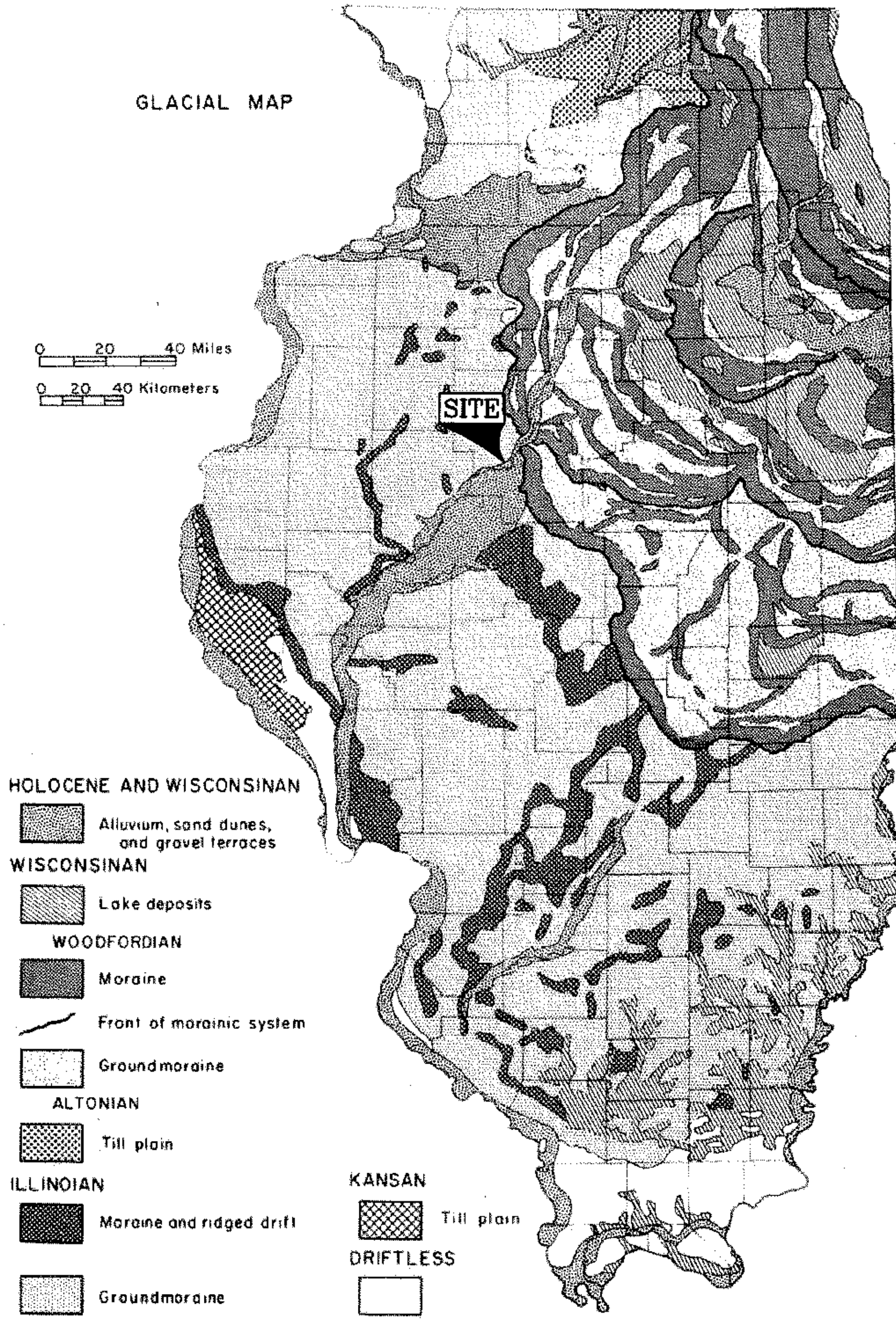


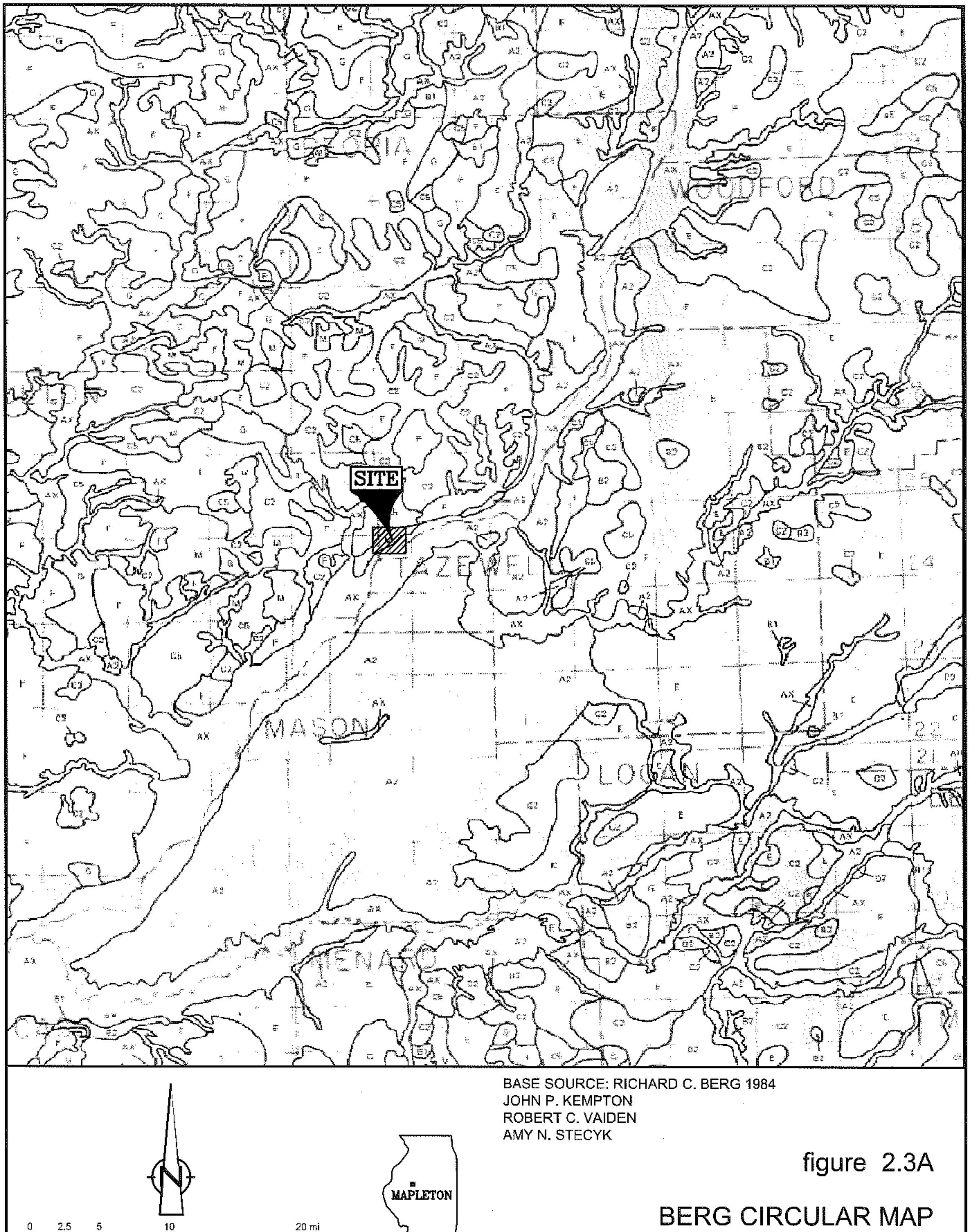
Fig. Q-2—Glacial map of Illinois (after Willman and Frye, 1970).

figure 2.2

GLACIAL MAP OF ILLINOIS
AFTER WILLMAN AND FRYE, 1970
CATERPILLAR INC.
Mapleton, Illinois

CRA

13307-00(004)GN-CO005 MAY 04/2010

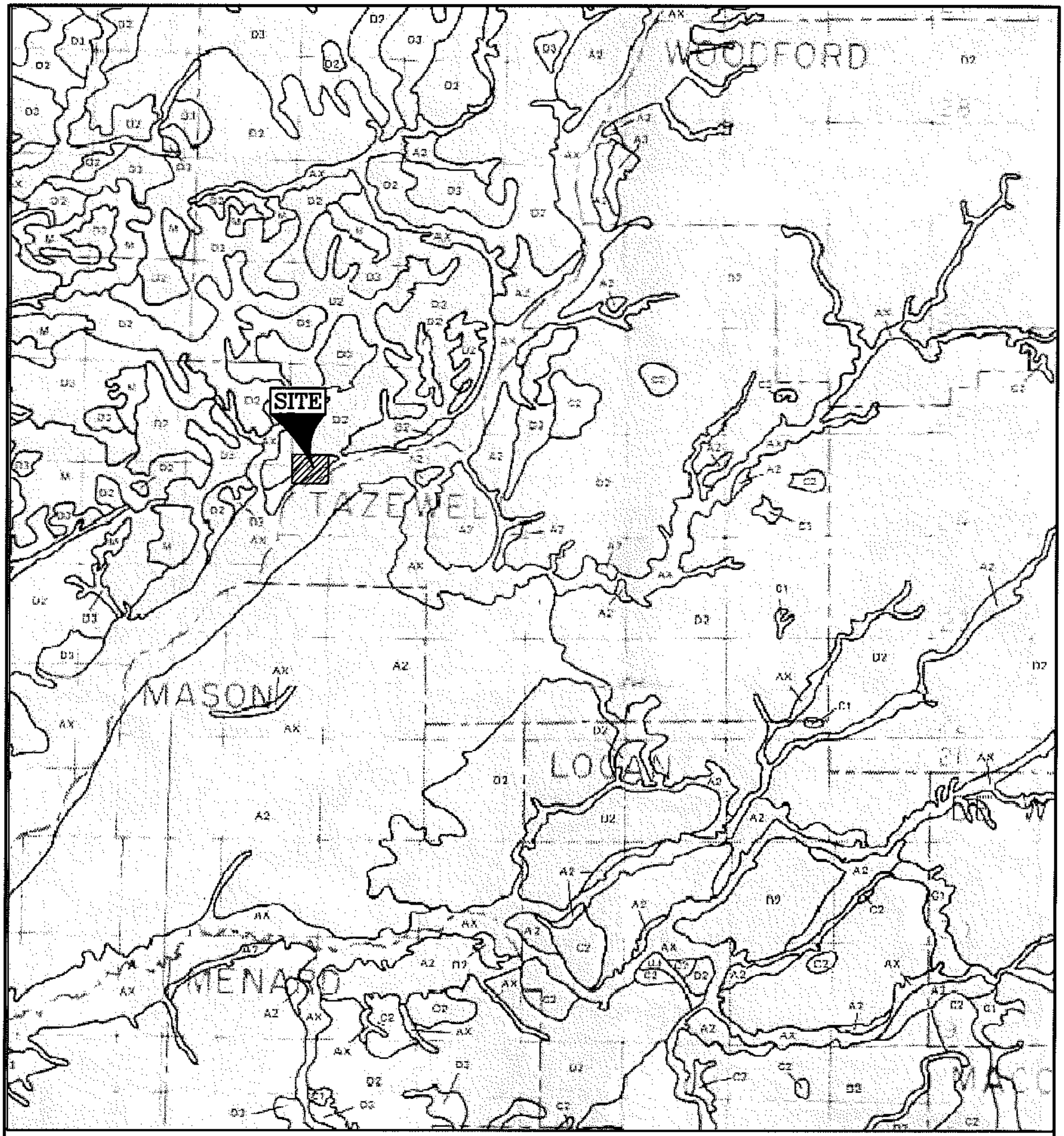


BASE SOURCE: RICHARD C. BERG 1984
JOHN P. KEMPTON
ROBERT C. VAIDEN
AMY N. STECYK

figure 2.3A

BERG CIRCULAR MAP
PLATE 1
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO006 MAY 04/2010



BASE SOURCE: RICHARD C. BERG 1984
JOHN P. KEMPTON
ROBERT C. VAIDEN
AMY N. STECYK

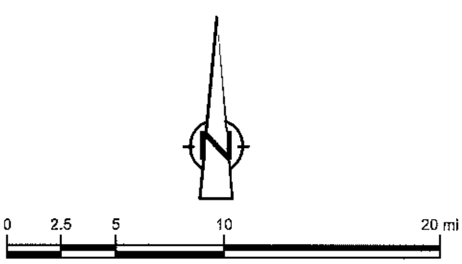
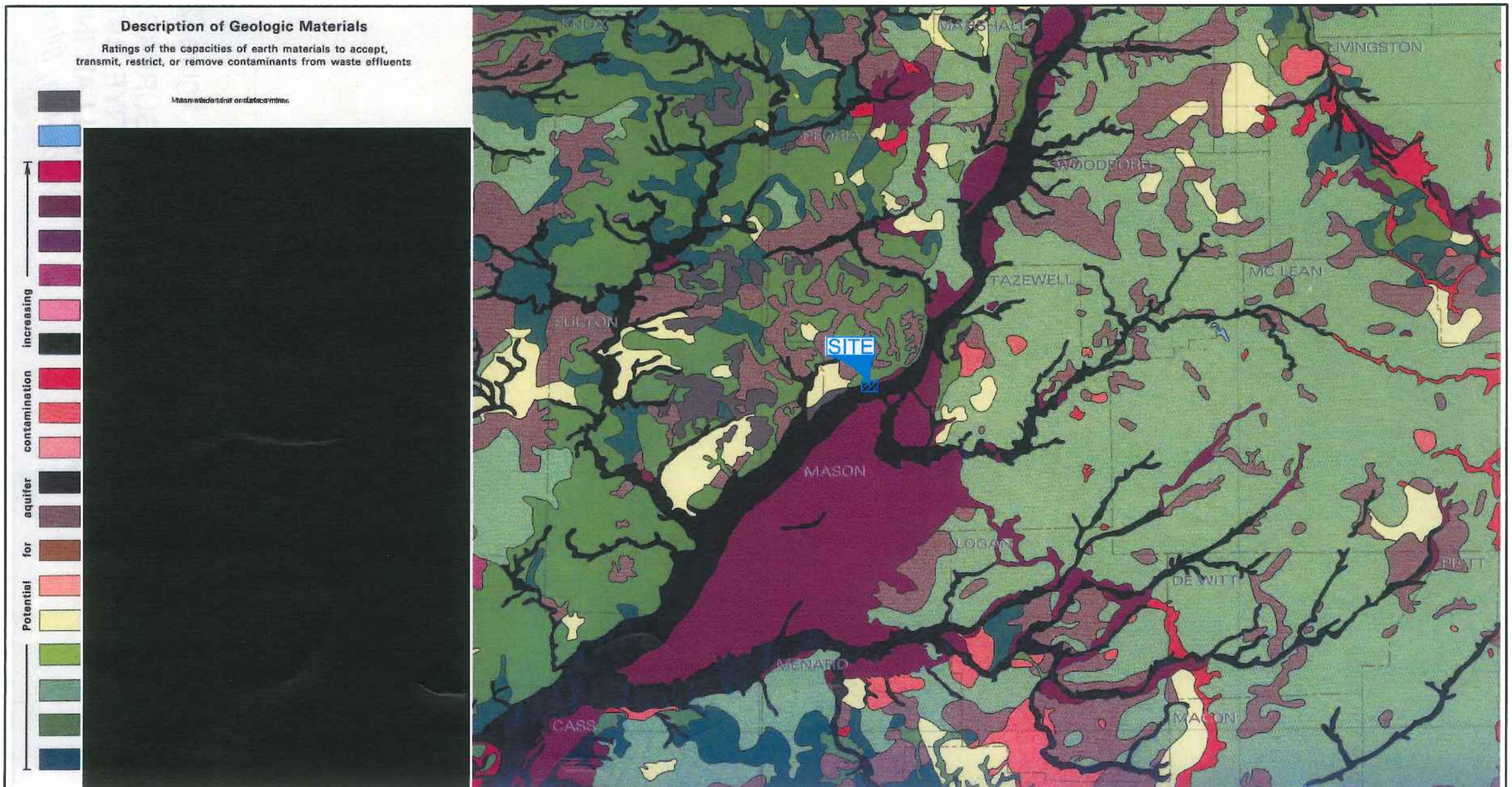
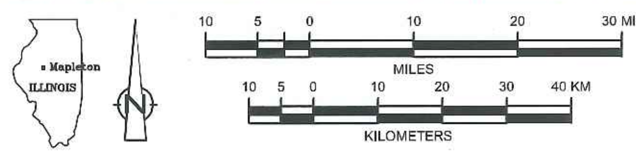


figure 2.3B

BERG CIRCULAR MAP
PLATE 2
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO007 MAY 04/2010





SOURCE:
ILLINOIS DEPARTMENT OF ENERGY AND NATURAL RESOURCES
ILLINOIS STATE GEOLOGICAL SURVEY

figure 2.4

STACK-UNIT MAP
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO008 MAY 04/2010

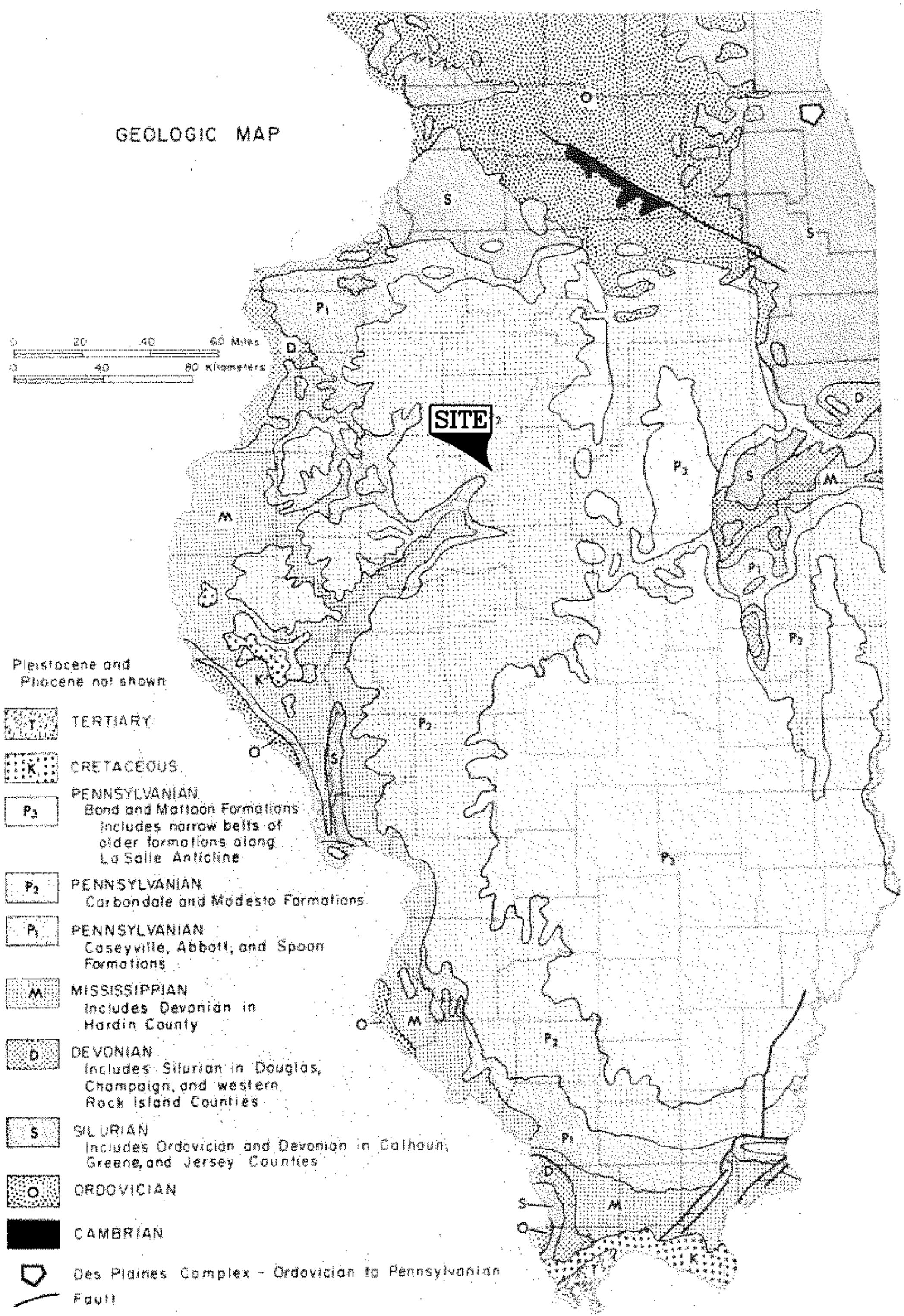


figure 2.5

GENERALIZED AREAL GEOLOGY OF THE BEDROCK SURFACE
WILLMAN AND FRYE, 1970
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO009 MAY 04/2010

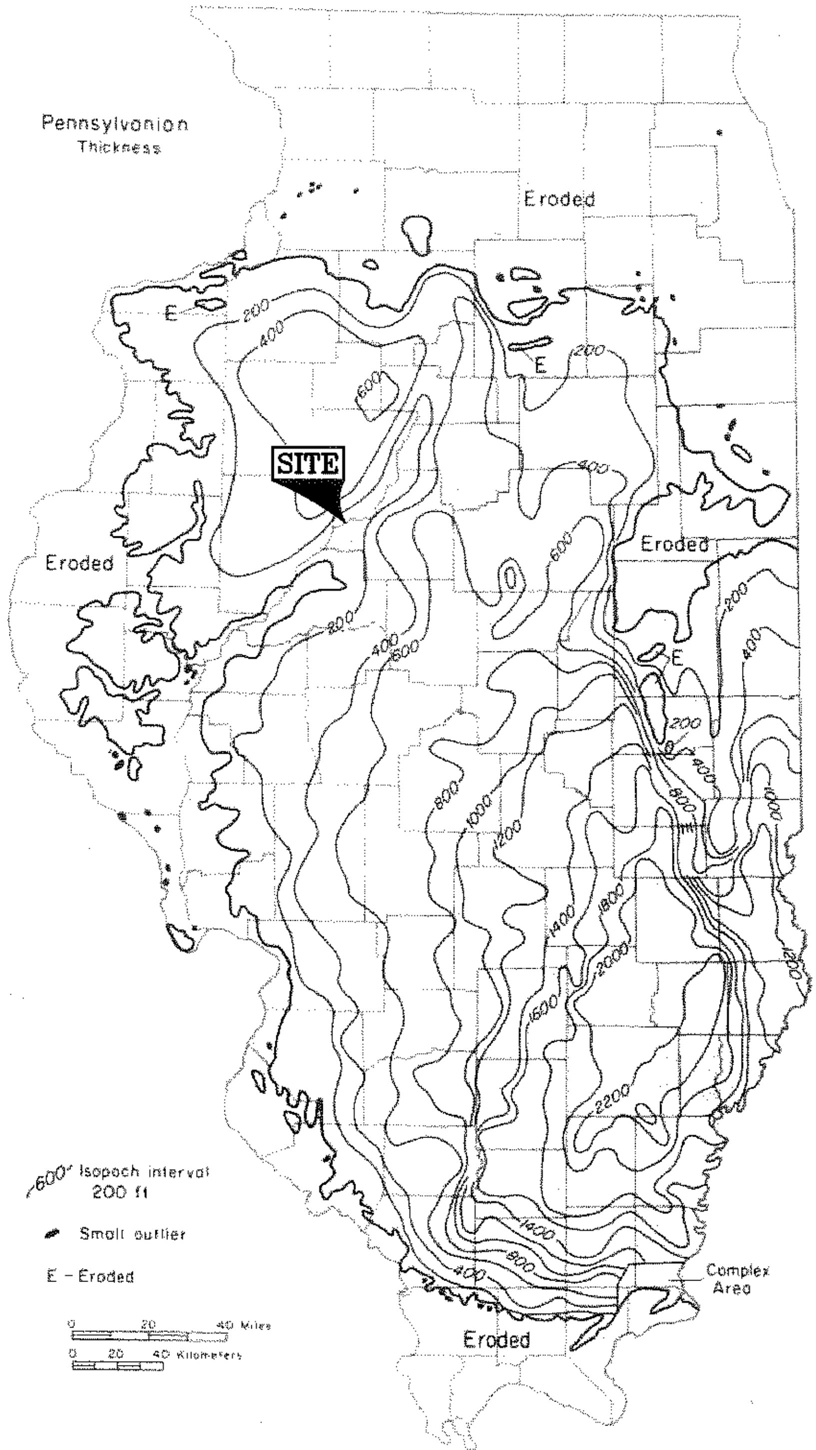


figure 2.6

THICKNESS OF THE PENNSYLVANIAN SYSTEM
CATERPILLAR INC.
Mapleton, Illinois

Kewanee Group

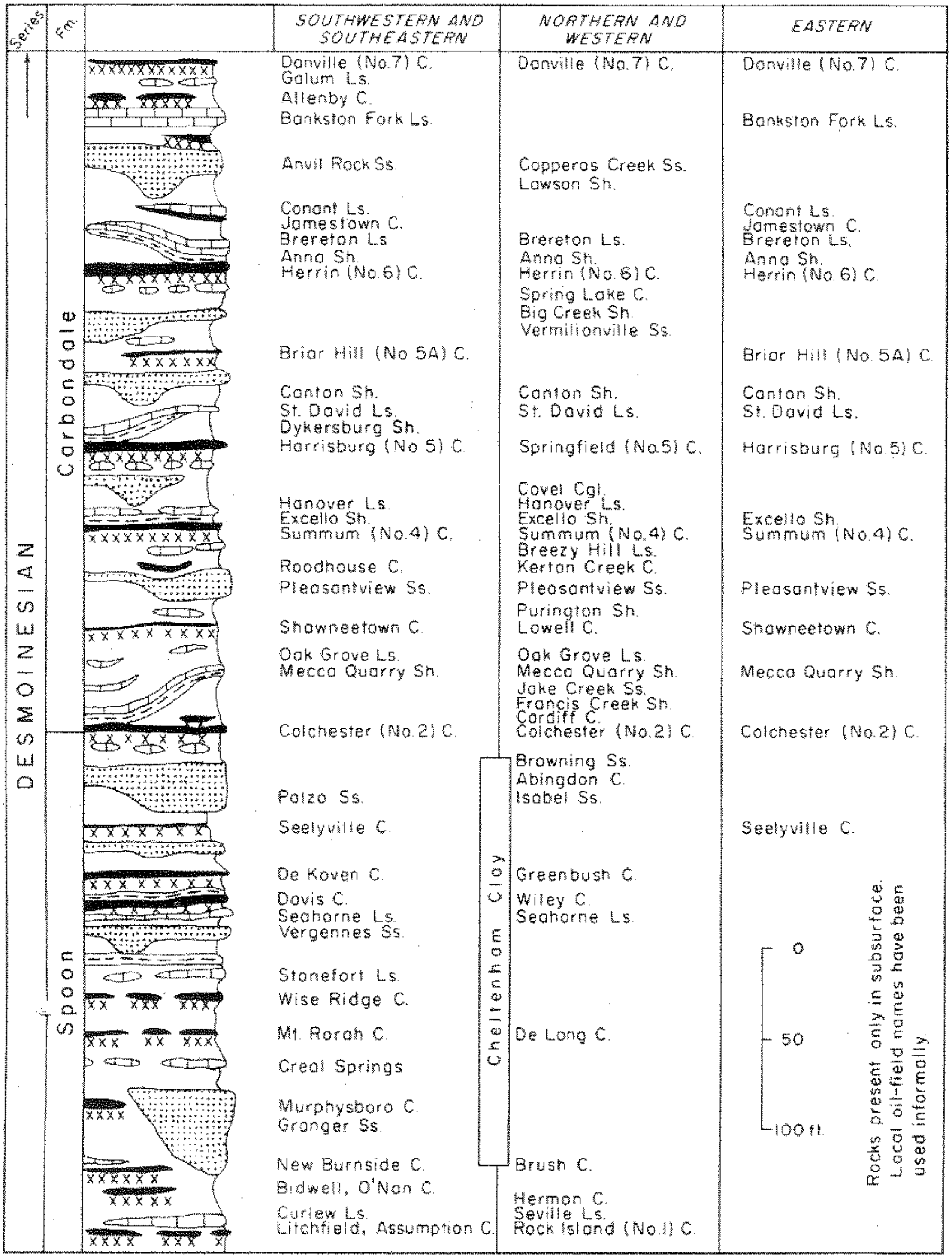


figure 2.7A

KEWANEE GROUP
CATERPILLAR INC.
Mapleton, Illinois

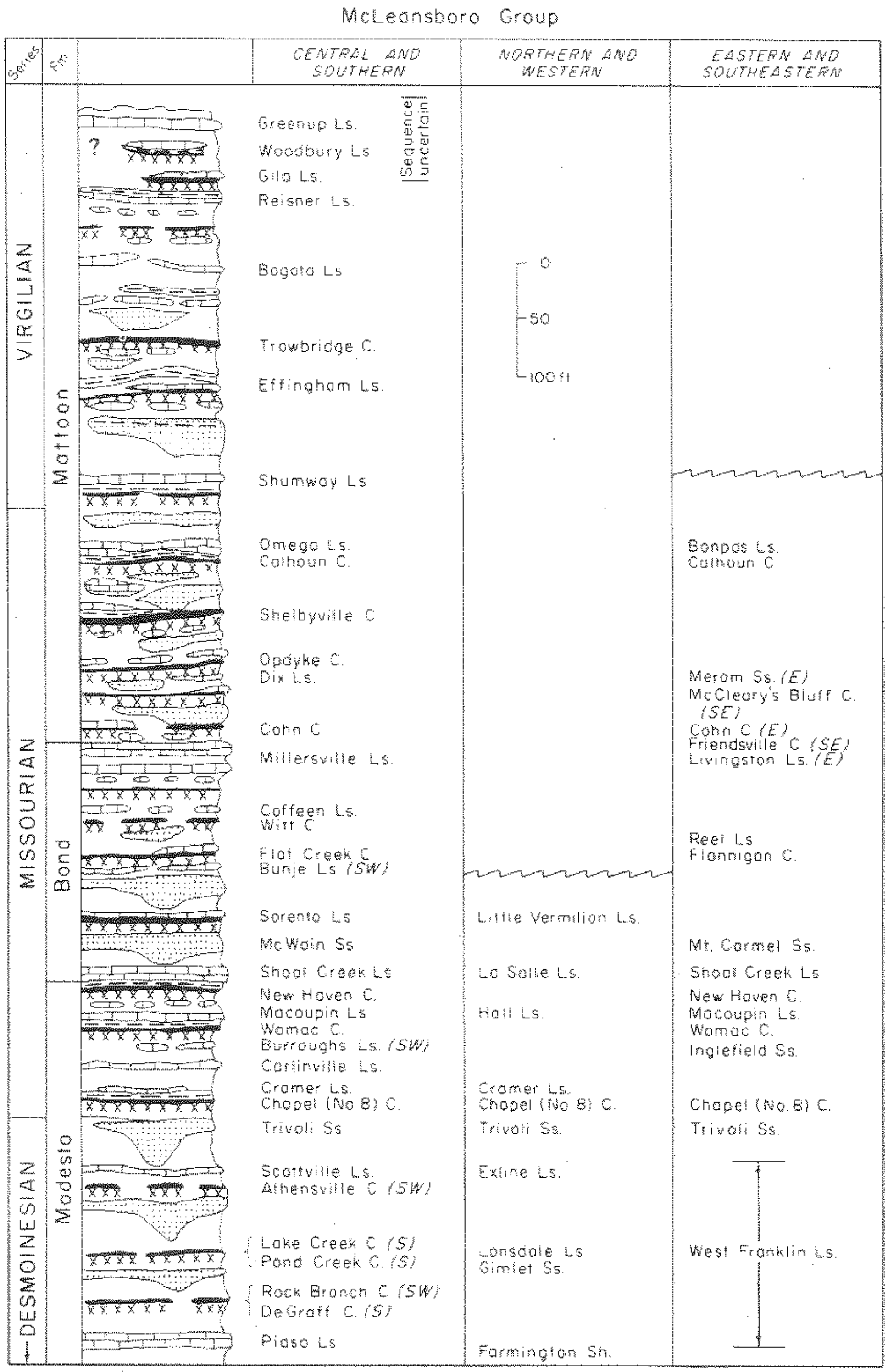
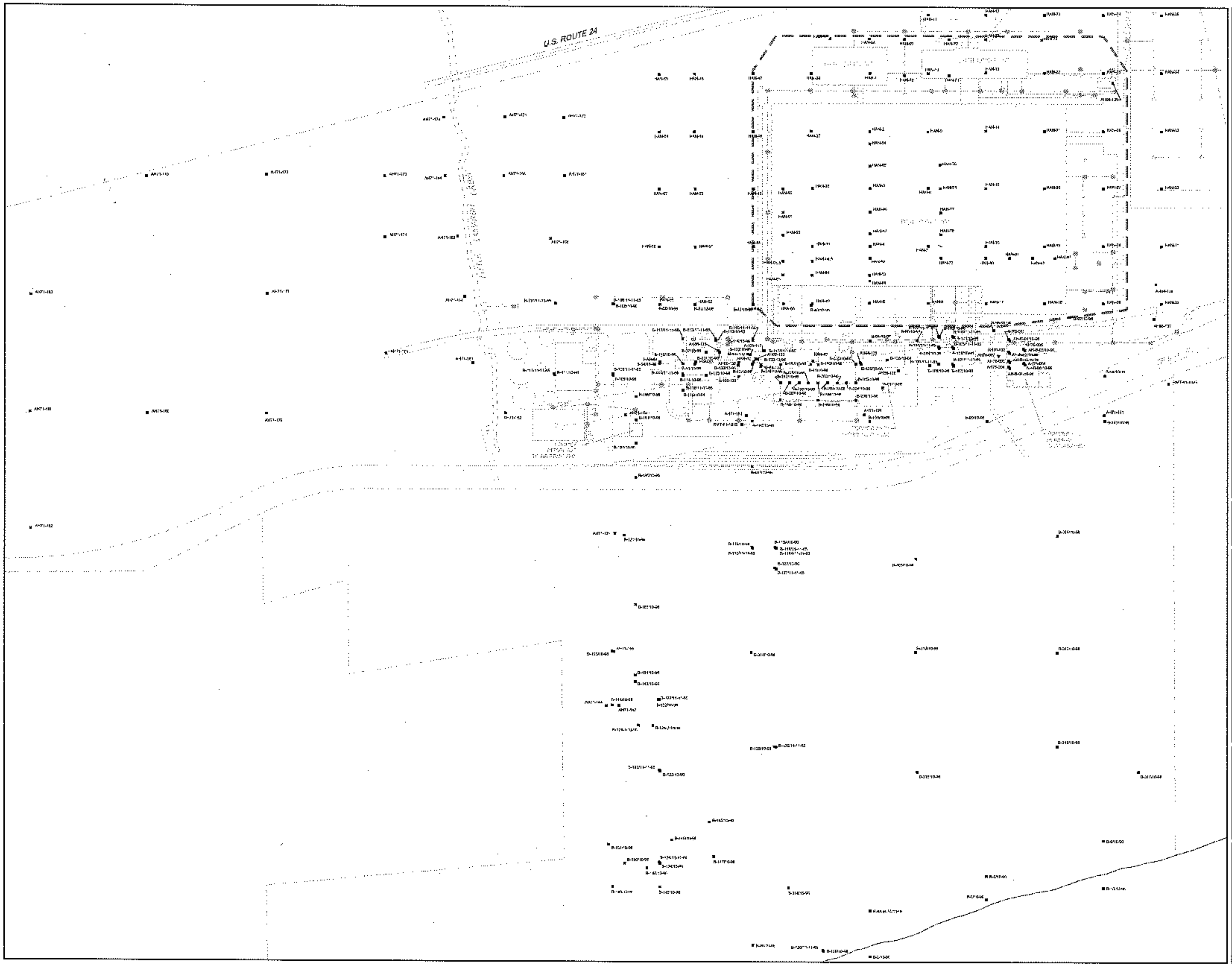


figure 2.7B

McLEANSBORO GROUP
CATERPILLAR INC.
Mapleton, Illinois



No.	Revision	Date	Initial

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

CATERPILLAR INC.
MAPLETON, ILLINOIS

13307-00

PLANT PROPERTY
HISTORIC SOIL BORING LOCATIONS
1964-1965

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:	See Above.		
Project Manager: S. WANNER	Reviewed By:	Date: AUGUST 24, 1999	
Scale: AS SHOWN	Project No: 13307-00	Report No: 004	Drawing No: fig. 2.8

13307-00(004)GN-CO013 MAY 04/2010

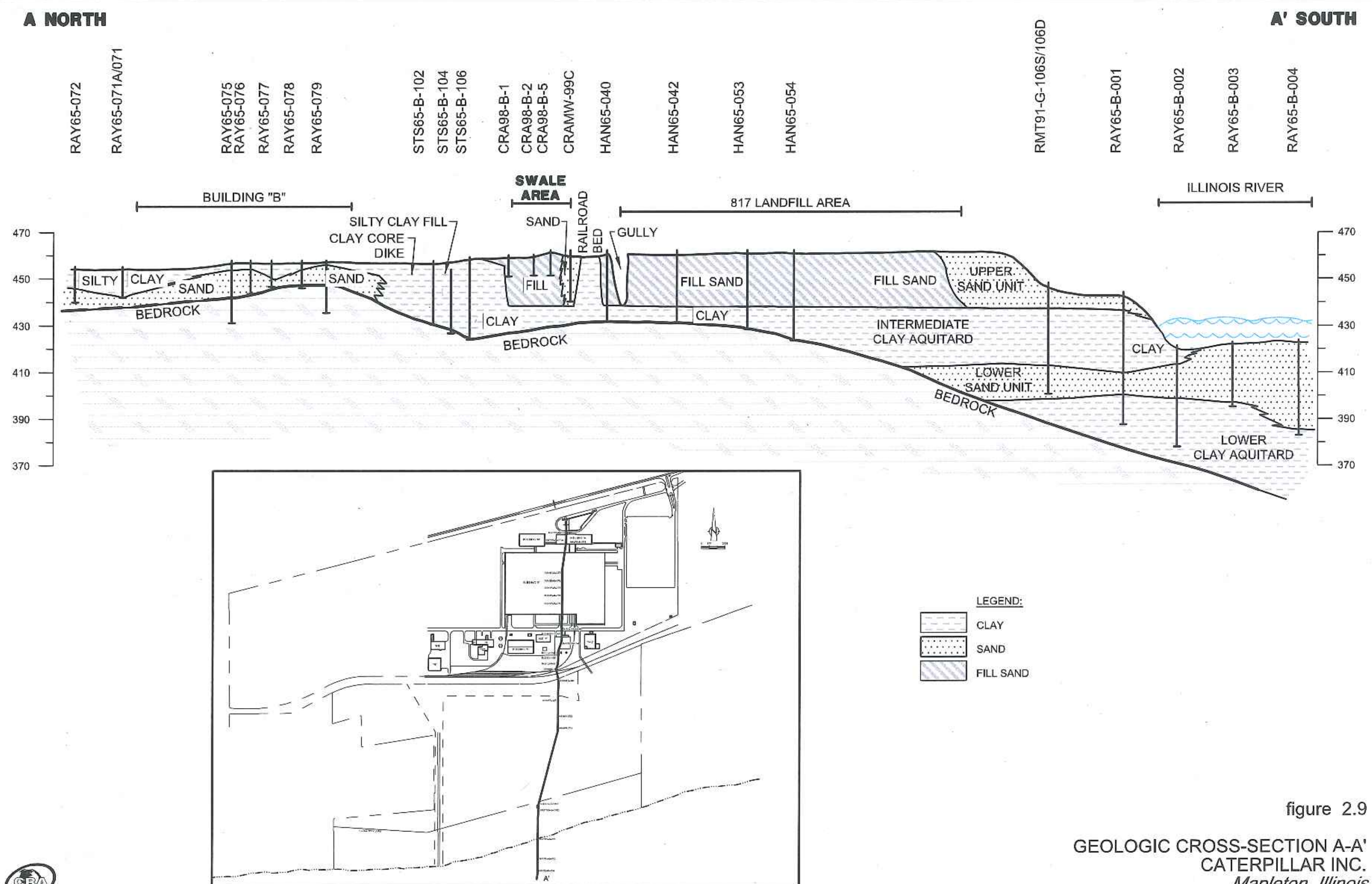


figure 2.9

GEOLOGIC CROSS-SECTION A-A'
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO014 MAY 04/2010

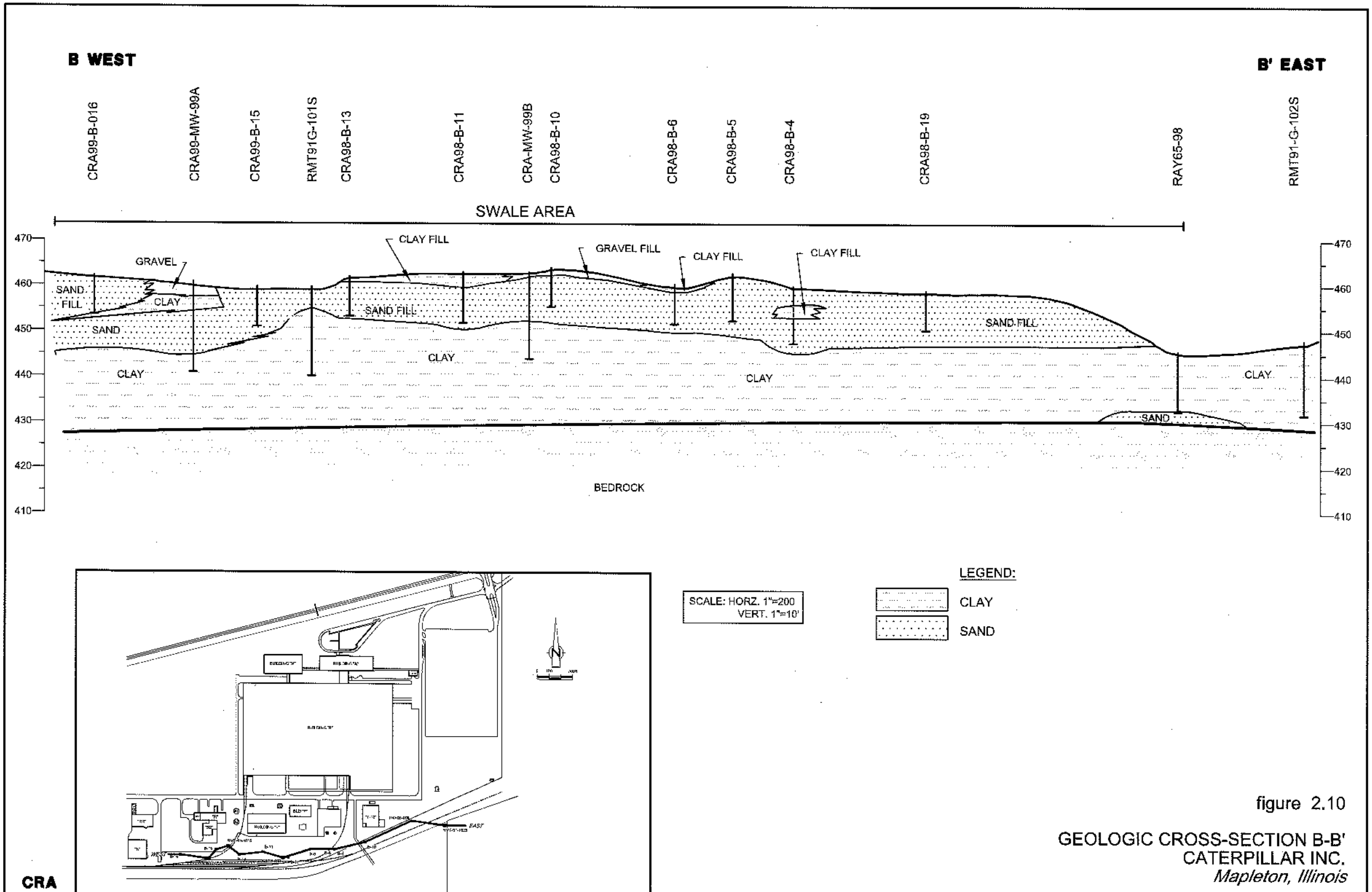


figure 2.10

GEOLOGIC CROSS-SECTION B-B'
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO015 MAY 04/2010

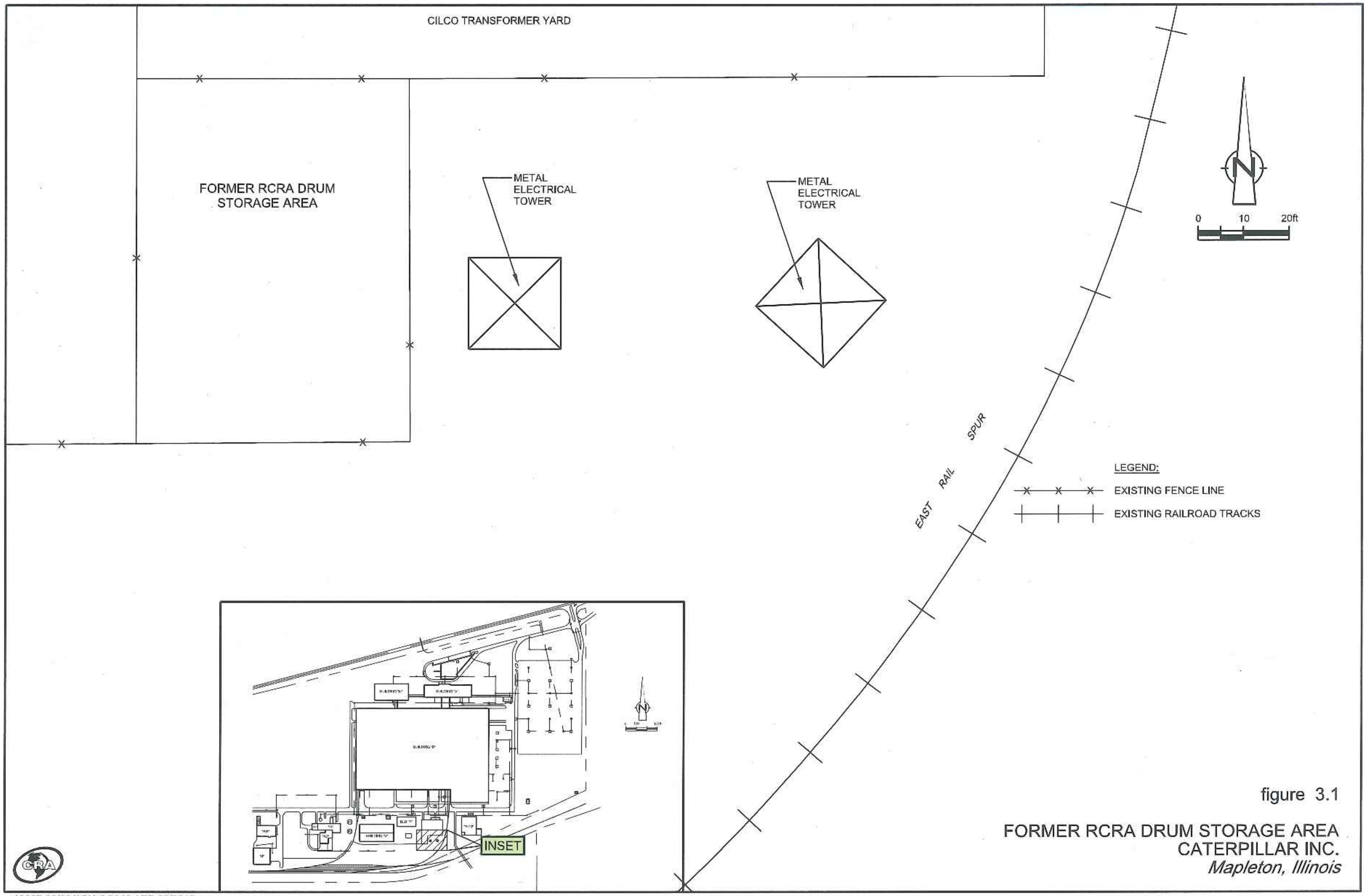


figure 3.1

FORMER RCRA DRUM STORAGE AREA
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO016 APR 20/2010

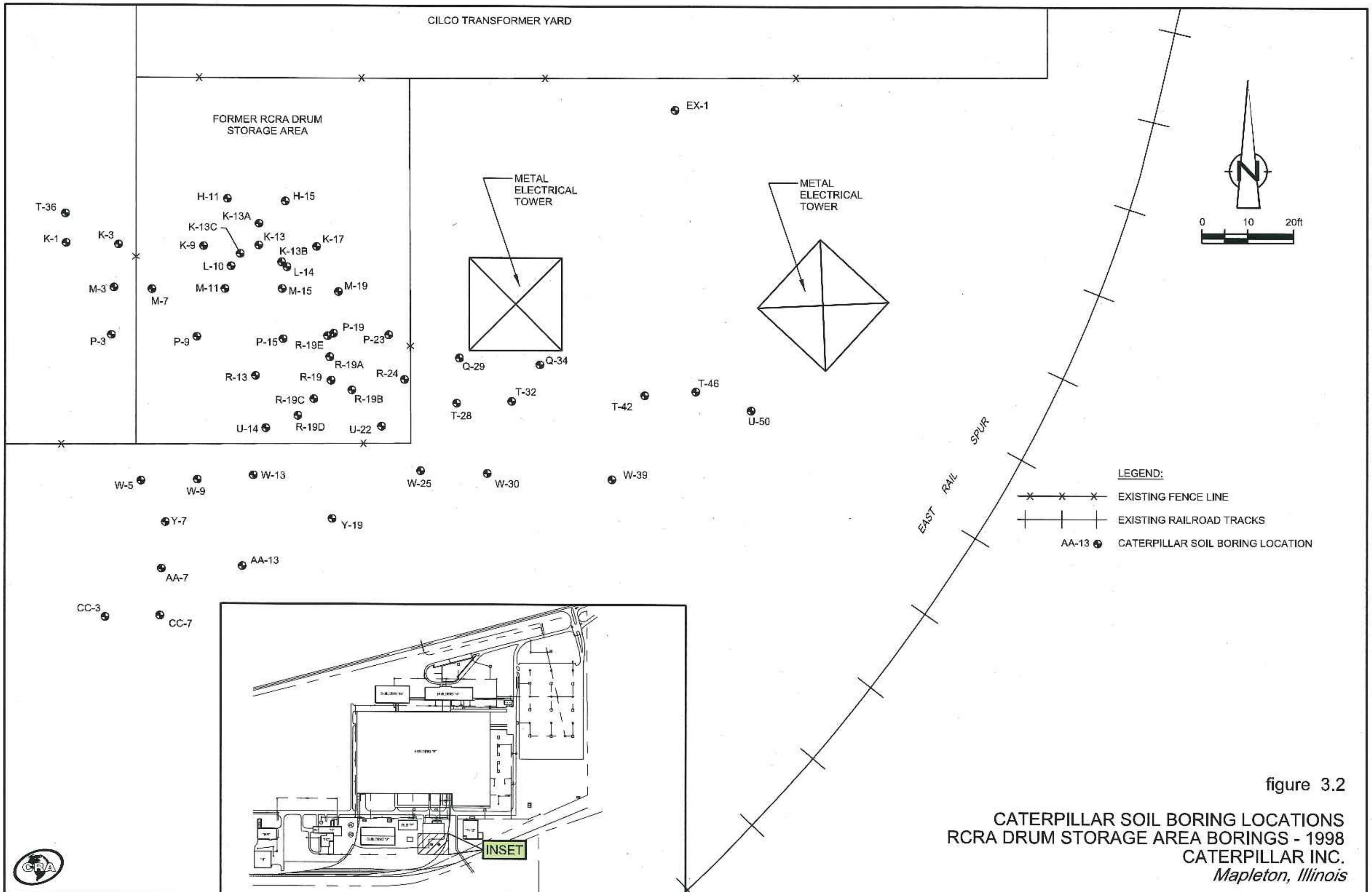


figure 3.2

CATERPILLAR SOIL BORING LOCATIONS
RCRA DRUM STORAGE AREA BORINGS - 1998
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO017 MAY 05/2010

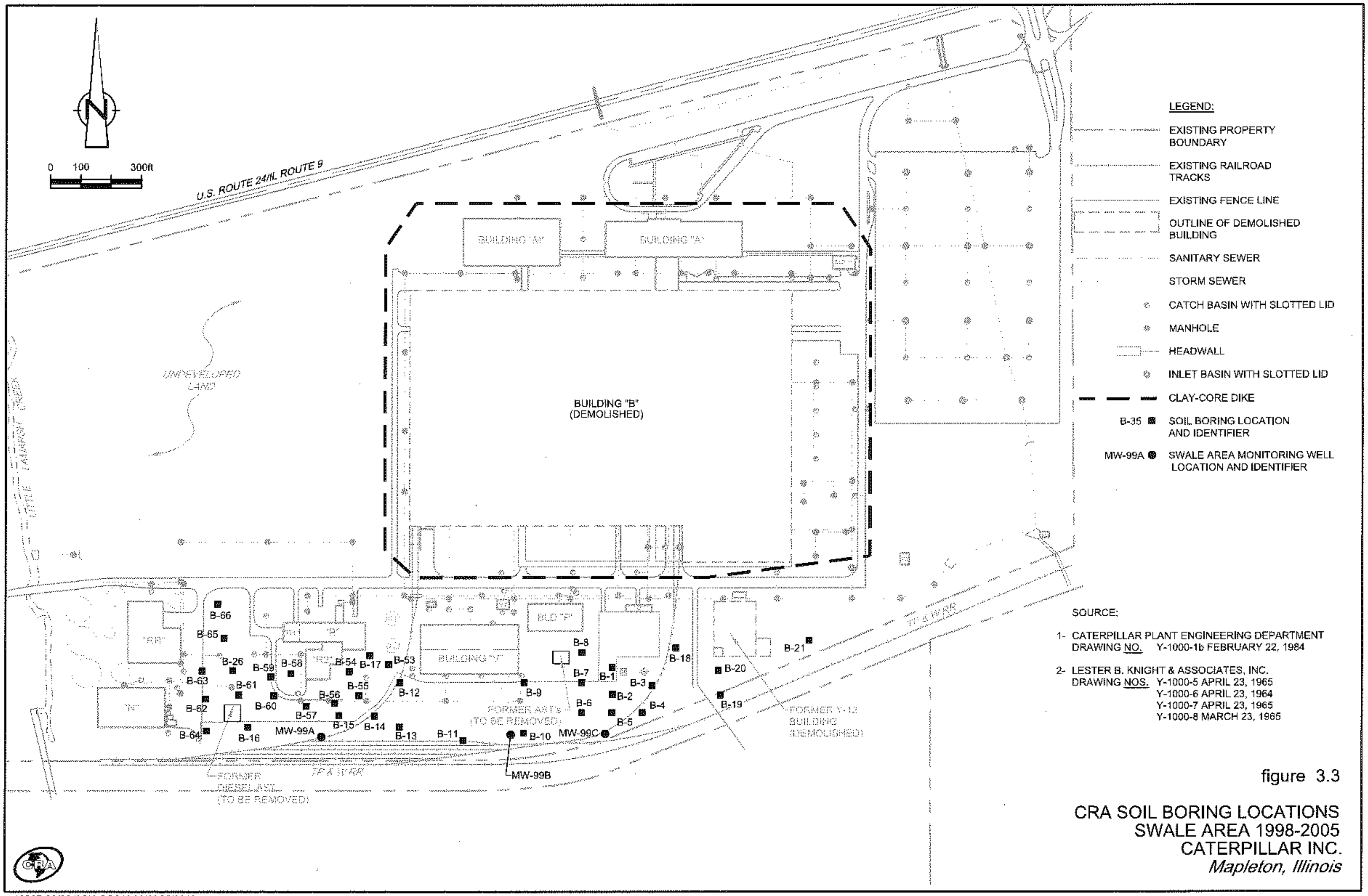


figure 3.3

CRA SOIL BORING LOCATIONS
SWALE AREA 1998-2005
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO018 MAY 05/2010

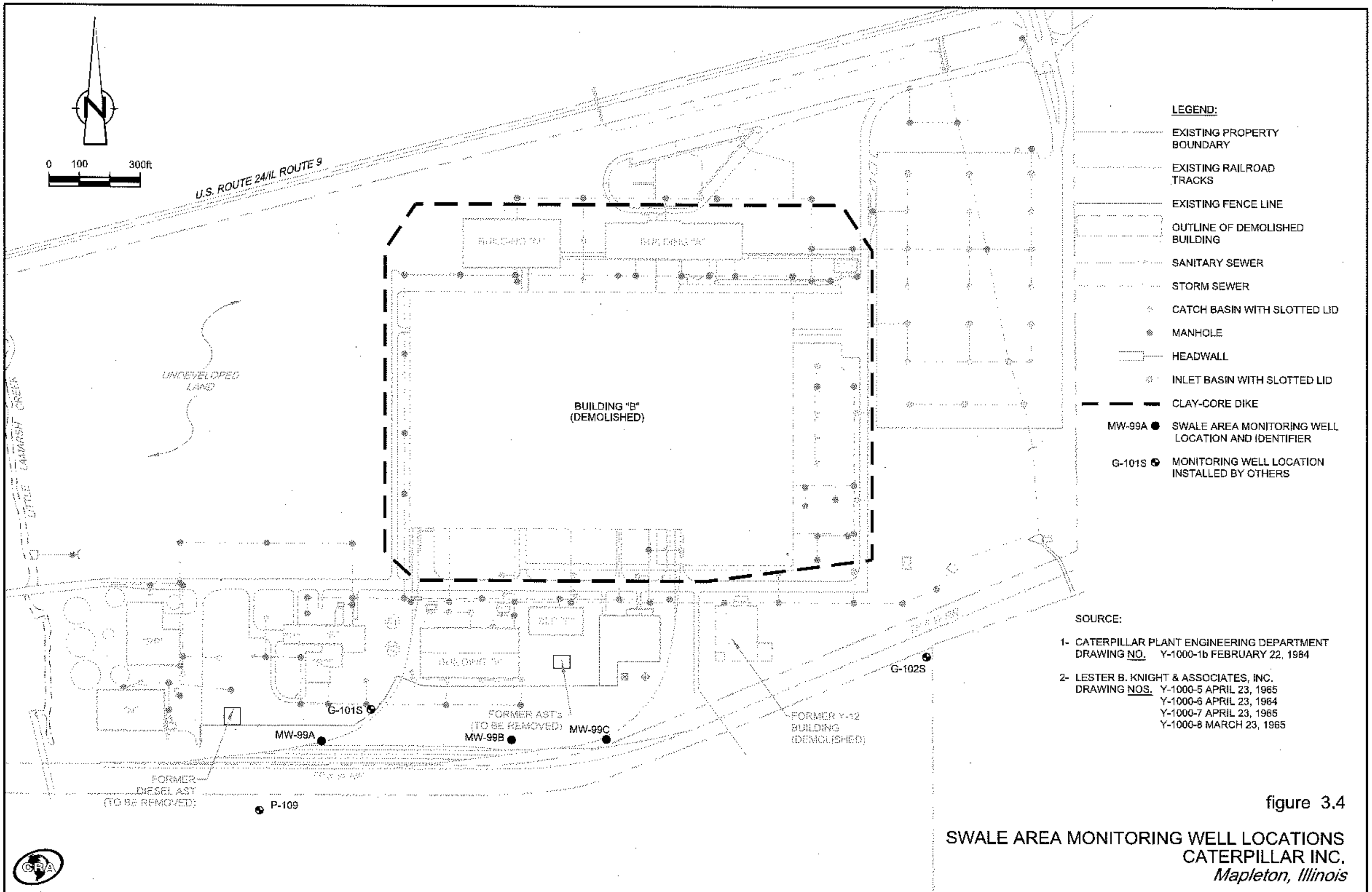


figure 3.4

SWALE AREA MONITORING WELL LOCATIONS
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO019 MAY 04/2010

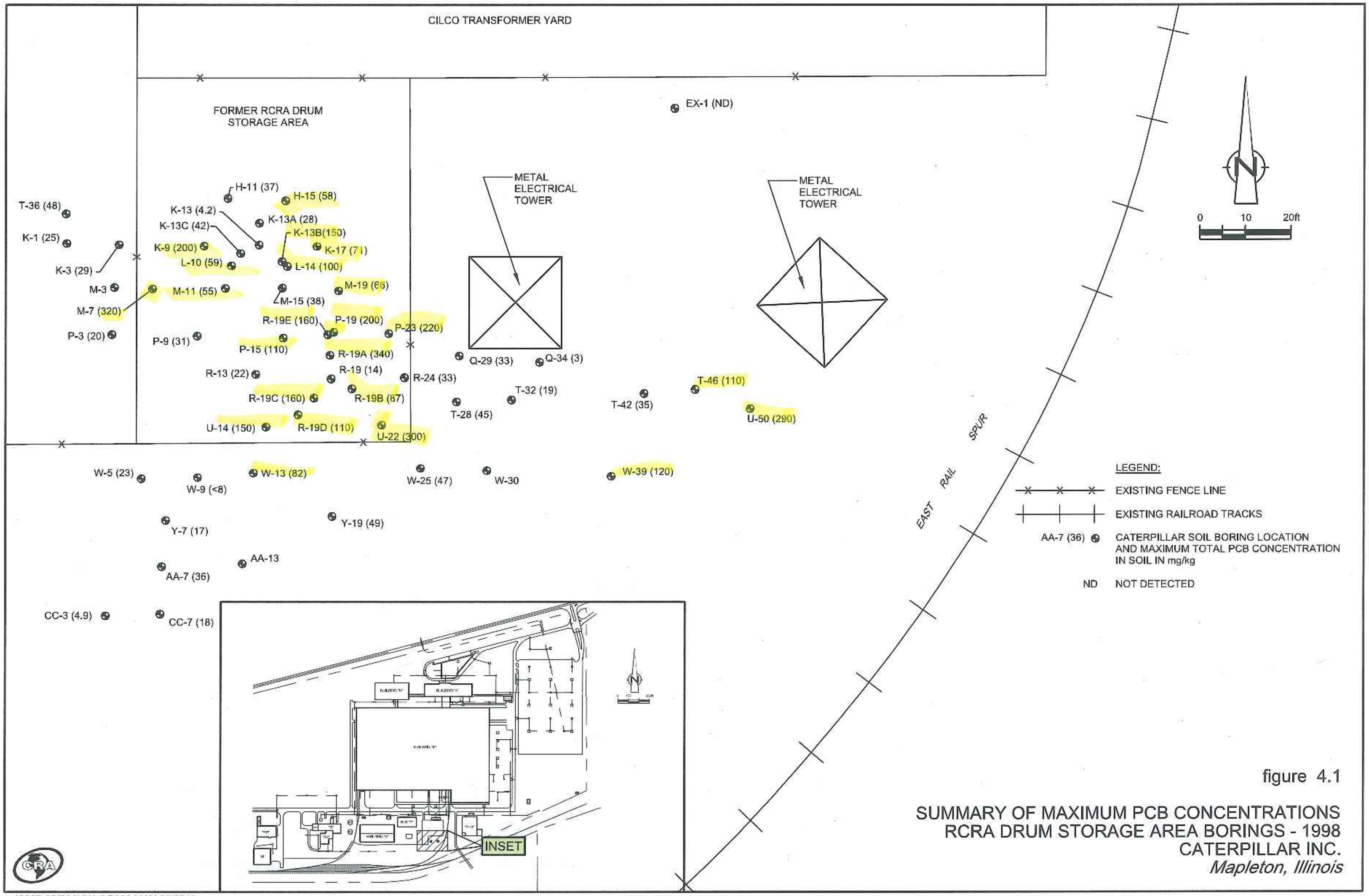
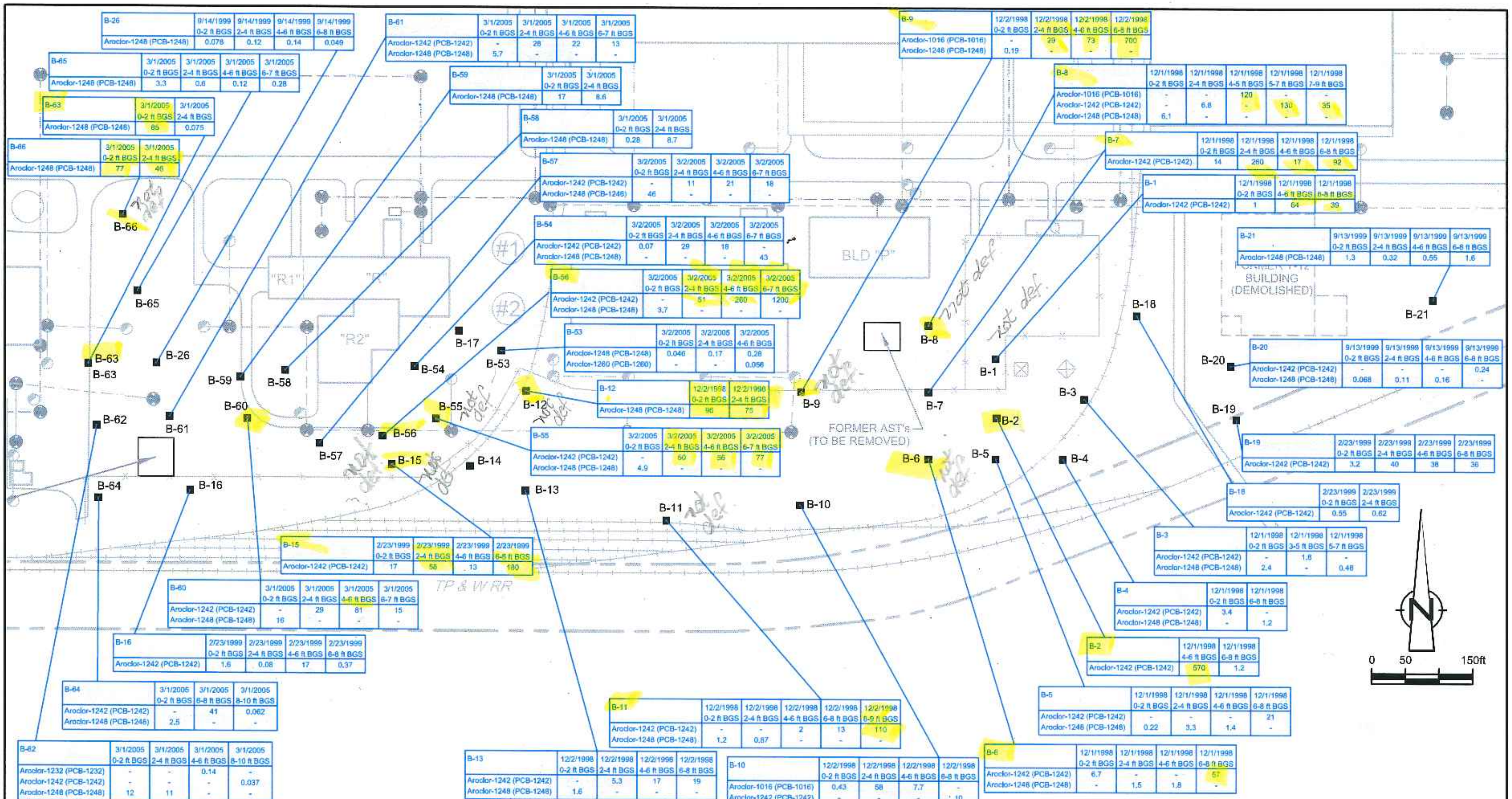


figure 4.1

SUMMARY OF MAXIMUM PCB CONCENTRATIONS
RCRA DRUM STORAGE AREA BORINGS - 1998
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO020 MAY 06/2010



B-26	9/14/1999 0-2 ft BGS	9/14/1999 2-4 ft BGS	9/14/1999 4-6 ft BGS	9/14/1999 6-8 ft BGS
Aroclor-1248 (PCB-1248)	0.078	0.12	0.14	0.049

B-65	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS	3/1/2005 4-6 ft BGS	3/1/2005 6-7 ft BGS
Aroclor-1248 (PCB-1248)	3.3	0.6	0.12	0.28

B-63	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS
Aroclor-1248 (PCB-1248)	85	0.075

B-66	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS
Aroclor-1248 (PCB-1248)	77	46

B-61	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS	3/1/2005 4-6 ft BGS	3/1/2005 6-7 ft BGS
Aroclor-1242 (PCB-1242)	-	28	22	13
Aroclor-1248 (PCB-1248)	5.7	-	-	-

B-59	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS
Aroclor-1248 (PCB-1248)	17	8.6

B-58	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS
Aroclor-1248 (PCB-1248)	0.28	8.7

B-57	3/2/2005 0-2 ft BGS	3/2/2005 2-4 ft BGS	3/2/2005 4-6 ft BGS	3/2/2005 6-7 ft BGS
Aroclor-1242 (PCB-1242)	-	11	21	18
Aroclor-1248 (PCB-1248)	46	-	-	-

B-54	3/2/2005 0-2 ft BGS	3/2/2005 2-4 ft BGS	3/2/2005 4-6 ft BGS	3/2/2005 6-7 ft BGS
Aroclor-1242 (PCB-1242)	0.07	29	18	-
Aroclor-1248 (PCB-1248)	-	-	-	43

B-56	3/2/2005 0-2 ft BGS	3/2/2005 2-4 ft BGS	3/2/2005 4-6 ft BGS	3/2/2005 6-7 ft BGS
Aroclor-1242 (PCB-1242)	-	51	260	1200
Aroclor-1248 (PCB-1248)	3.7	-	-	-

B-53	3/2/2005 0-2 ft BGS	3/2/2005 2-4 ft BGS	3/2/2005 4-6 ft BGS
Aroclor-1248 (PCB-1248)	0.046	0.17	0.28
Aroclor-1260 (PCB-1260)	-	-	0.056

B-12	12/2/1998 0-2 ft BGS	12/2/1998 2-4 ft BGS
Aroclor-1248 (PCB-1248)	96	75

B-55	3/2/2005 0-2 ft BGS	3/2/2005 2-4 ft BGS	3/2/2005 4-6 ft BGS	3/2/2005 6-7 ft BGS
Aroclor-1242 (PCB-1242)	-	60	56	77
Aroclor-1248 (PCB-1248)	4.9	-	-	-

B-9	12/2/1998 0-2 ft BGS	12/2/1998 2-4 ft BGS	12/2/1998 4-6 ft BGS	12/2/1998 6-8 ft BGS
Aroclor-1016 (PCB-1016)	-	29	73	700
Aroclor-1248 (PCB-1248)	0.19	-	-	-

B-8	12/1/1998 0-2 ft BGS	12/1/1998 2-4 ft BGS	12/1/1998 4-5 ft BGS	12/1/1998 5-7 ft BGS	12/1/1998 7-9 ft BGS
Aroclor-1016 (PCB-1016)	-	-	120	-	-
Aroclor-1242 (PCB-1242)	-	6.8	-	130	35
Aroclor-1248 (PCB-1248)	6.1	-	-	-	-

B-7	12/1/1998 0-2 ft BGS	12/1/1998 2-4 ft BGS	12/1/1998 4-6 ft BGS	12/1/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	14	260	17	92

B-1	12/1/1998 0-2 ft BGS	12/1/1998 4-6 ft BGS	12/1/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	1	64	39

B-21	9/13/1999 0-2 ft BGS	9/13/1999 2-4 ft BGS	9/13/1999 4-6 ft BGS	9/13/1999 6-8 ft BGS
Aroclor-1248 (PCB-1248)	1.3	0.32	0.55	1.6

B-20	9/13/1999 0-2 ft BGS	9/13/1999 2-4 ft BGS	9/13/1999 4-6 ft BGS	9/13/1999 6-8 ft BGS
Aroclor-1242 (PCB-1242)	-	-	-	0.24
Aroclor-1248 (PCB-1248)	0.068	0.11	0.16	-

B-19	2/23/1999 0-2 ft BGS	2/23/1999 2-4 ft BGS	2/23/1999 4-6 ft BGS	2/23/1999 6-8 ft BGS
Aroclor-1242 (PCB-1242)	3.2	40	38	36

B-18	2/23/1999 0-2 ft BGS	2/23/1999 2-4 ft BGS
Aroclor-1242 (PCB-1242)	0.55	0.62

B-3	12/1/1998 0-2 ft BGS	12/1/1998 3-5 ft BGS	12/1/1998 5-7 ft BGS
Aroclor-1242 (PCB-1242)	-	1.8	-
Aroclor-1248 (PCB-1248)	2.4	-	0.48

B-4	12/1/1998 0-2 ft BGS	12/1/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	3.4	-
Aroclor-1248 (PCB-1248)	-	1.2

B-2	12/1/1998 4-6 ft BGS	12/1/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	570	1.2

B-5	12/1/1998 0-2 ft BGS	12/1/1998 2-4 ft BGS	12/1/1998 4-6 ft BGS	12/1/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	-	-	-	21
Aroclor-1248 (PCB-1248)	0.22	3.3	1.4	-

B-6	12/1/1998 0-2 ft BGS	12/1/1998 2-4 ft BGS	12/1/1998 4-6 ft BGS	12/1/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	6.7	-	-	57
Aroclor-1248 (PCB-1248)	-	1.5	1.8	-

B-15	2/23/1999 0-2 ft BGS	2/23/1999 2-4 ft BGS	2/23/1999 4-6 ft BGS	2/23/1999 6-8 ft BGS
Aroclor-1242 (PCB-1242)	17	58	13	180

B-60	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS	3/1/2005 4-6 ft BGS	3/1/2005 6-7 ft BGS
Aroclor-1242 (PCB-1242)	-	29	81	15
Aroclor-1248 (PCB-1248)	16	-	-	-

B-16	2/23/1999 0-2 ft BGS	2/23/1999 2-4 ft BGS	2/23/1999 4-6 ft BGS	2/23/1999 6-8 ft BGS
Aroclor-1242 (PCB-1242)	1.6	0.08	17	0.37

B-64	3/1/2005 0-2 ft BGS	3/1/2005 6-8 ft BGS	3/1/2005 8-10 ft BGS
Aroclor-1242 (PCB-1242)	-	41	0.062
Aroclor-1248 (PCB-1248)	2.5	-	-

B-62	3/1/2005 0-2 ft BGS	3/1/2005 2-4 ft BGS	3/1/2005 4-6 ft BGS	3/1/2005 8-10 ft BGS
Aroclor-1232 (PCB-1232)	-	-	0.14	-
Aroclor-1242 (PCB-1242)	-	-	-	0.037
Aroclor-1248 (PCB-1248)	12	11	-	-

B-11	12/2/1998 0-2 ft BGS	12/2/1998 2-4 ft BGS	12/2/1998 4-6 ft BGS	12/2/1998 6-8 ft BGS	12/2/1998 8-9 ft BGS
Aroclor-1242 (PCB-1242)	-	-	2	13	110
Aroclor-1248 (PCB-1248)	1.2	0.87	-	-	-

B-13	12/2/1998 0-2 ft BGS	12/2/1998 2-4 ft BGS	12/2/1998 4-6 ft BGS	12/2/1998 6-8 ft BGS
Aroclor-1242 (PCB-1242)	-	5.3	17	19
Aroclor-1248 (PCB-1248)	1.6	-	-	-

B-10	12/2/1998 0-2 ft BGS	12/2/1998 2-4 ft BGS	12/2/1998 4-6 ft BGS	12/2/1998 6-8 ft BGS
Aroclor-1016 (PCB-1016)	0.43	58	7.7	-
Aroclor-1242 (PCB-1242)	-	-	-	10

LEGEND

EXISTING PROPERTY BOUNDARY

EXISTING RAILROAD TRACKS

EXISTING FENCE LINE

SANITARY SEWER

STORM SEWER

CATCH BASIN WITH SLOTTED LID

MANHOLE

HEADWALL

INLET BASIN WITH SLOTTED LID

B-35 ■ SOIL BORING LOCATION AND IDENTIFIER

B-1	12/1/1998 0-2 ft BGS
Aroclor-1242 (PCB-1242)	1

SAMPLE IDENTIFIER
SAMPLE DATE
SAMPLE DEPTH
SAMPLE RESULT (ug/kg)
DETECTED COMPOUND

figure 4.2

SUMMARY OF PCB DETECTED ANALYTICAL DATA
CRA SWALE AREA SOIL BORINGS 1998-2005
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO021 MAY 06/2010

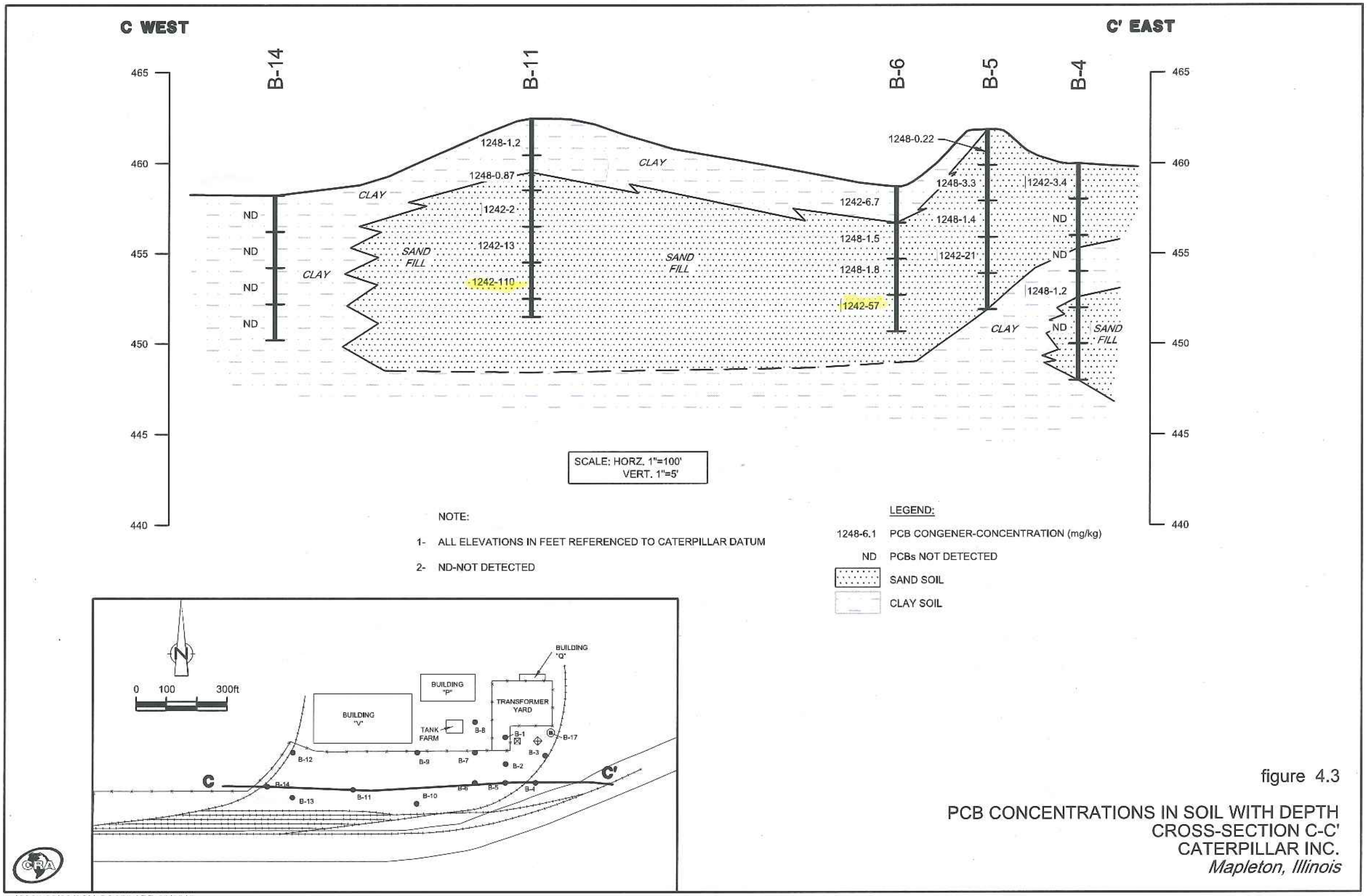
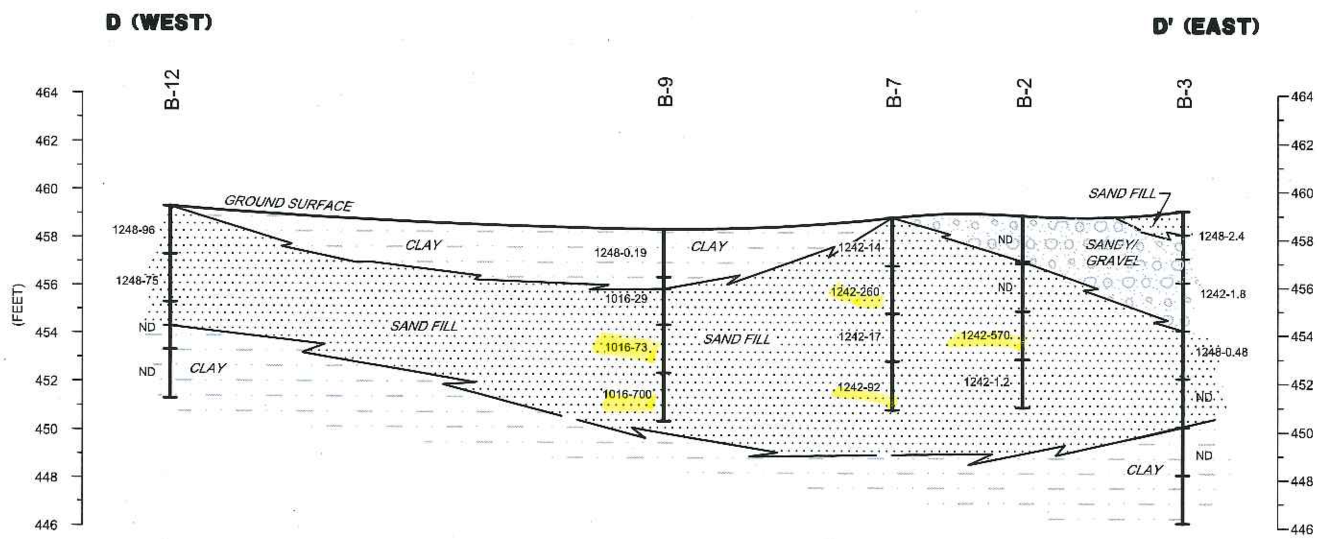


figure 4.3

PCB CONCENTRATIONS IN SOIL WITH DEPTH
CROSS-SECTION C-C'
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO022 APR 20/2010



NOTE:

1- ALL ELEVATIONS IN FEET REFERENCED TO CATERPILLAR DATUM

2- ND-NOT DETECTED

LEGEND:

1248-6.1 PCB CONGENER-CONCENTRATION (mg/kg)

ND PCBs NOT DETECTED

SANDY GRAVEL SOIL

SAND SOIL

CLAY SOIL

SCALE: HORZ. 1"=100'
VERT. 1"=5'

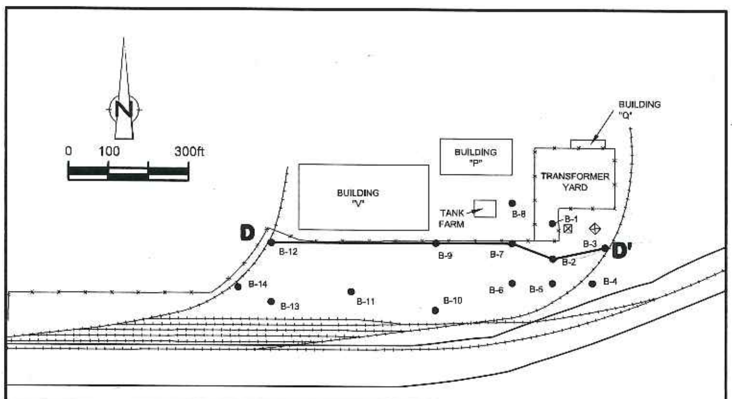


figure 4.4

PCB CONCENTRATIONS IN SOIL WITH DEPTH
CROSS-SECTION D-D'
CATERPILLAR INC.
Mapleton, Illinois

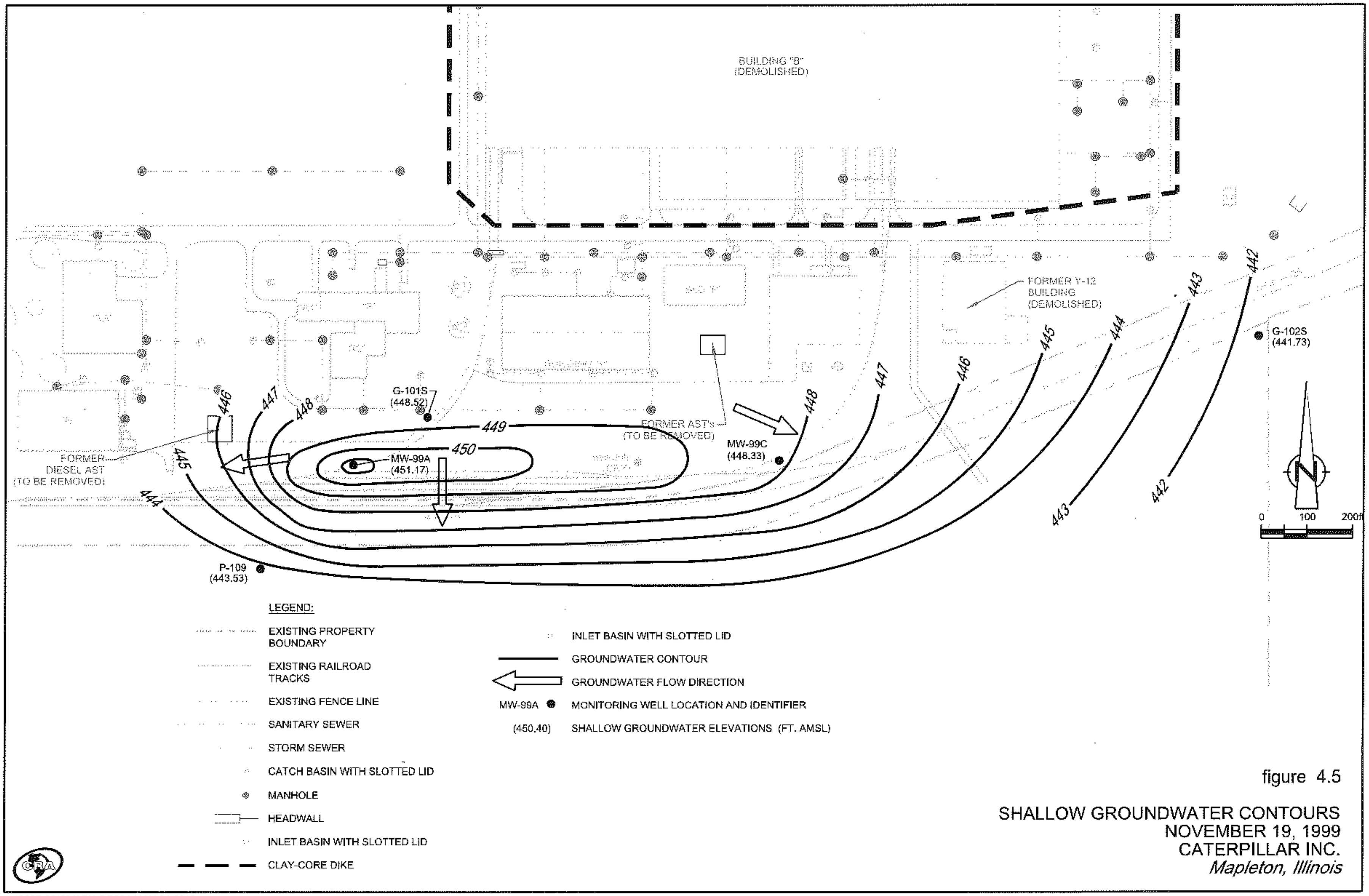


figure 4.5

SHALLOW GROUNDWATER CONTOURS
NOVEMBER 19, 1999
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO024 MAY 04/2010

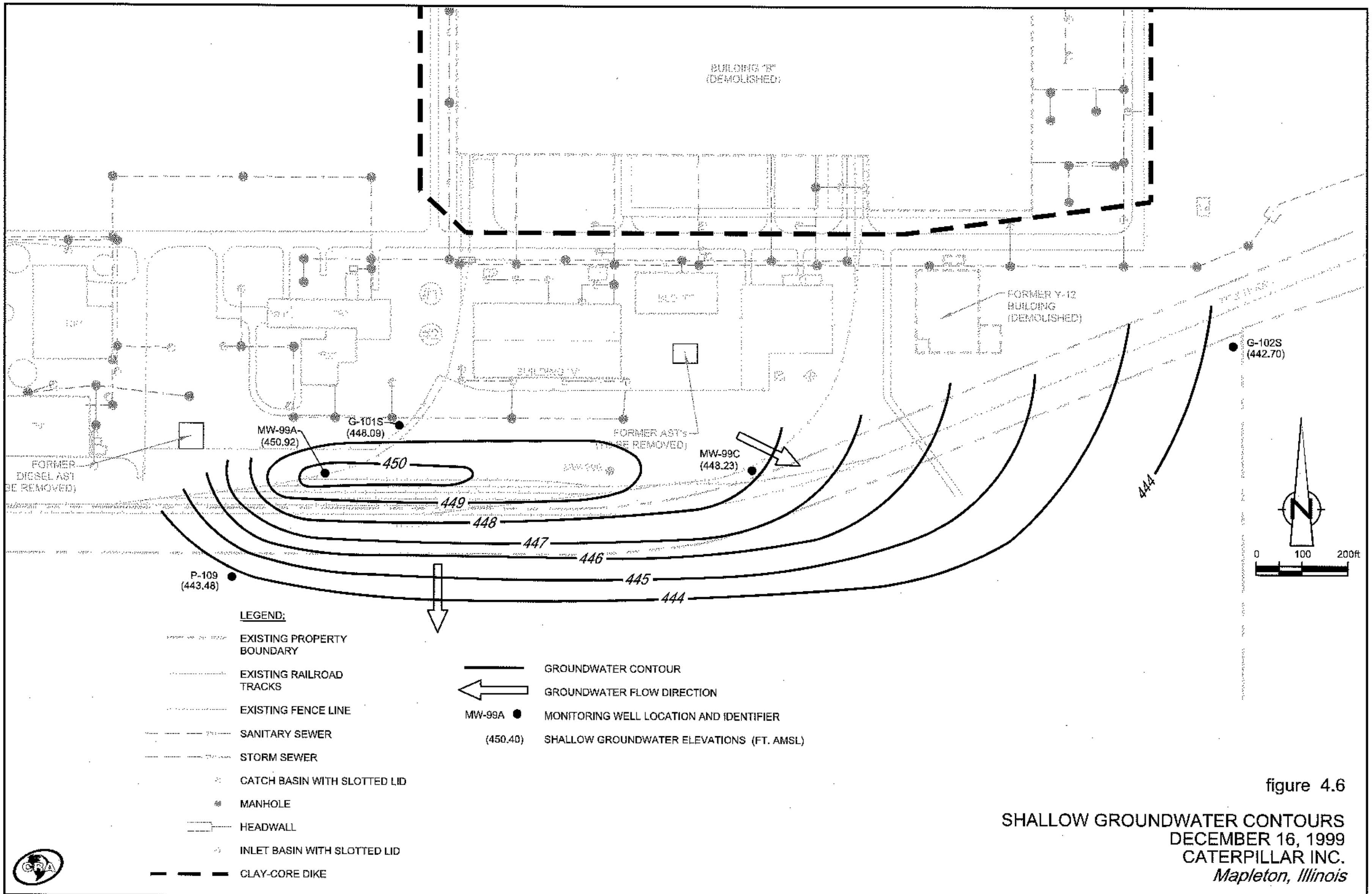


figure 4.6

SHALLOW GROUNDWATER CONTOURS
DECEMBER 16, 1999
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO025 MAY 04/2010

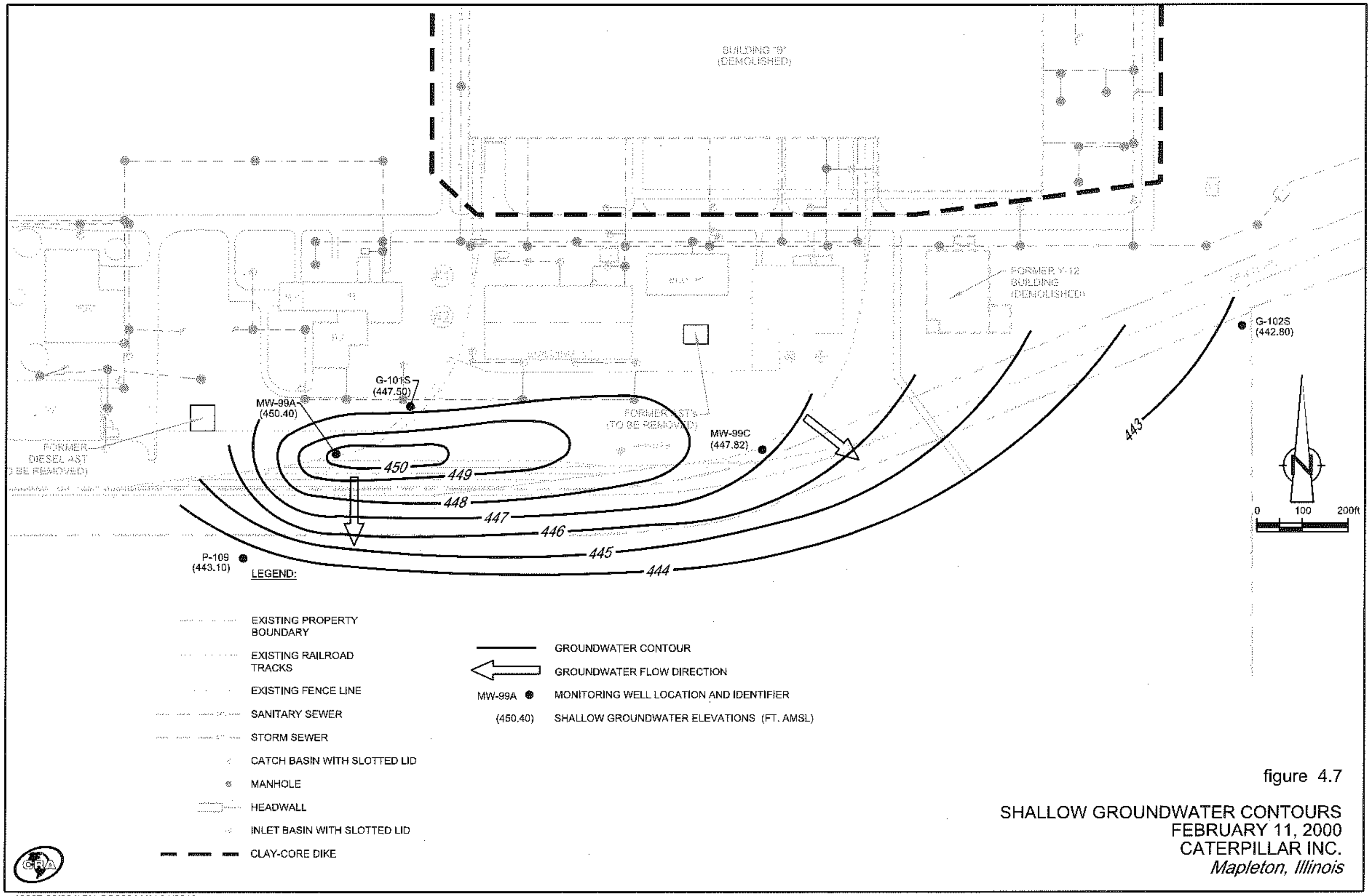


figure 4.7

SHALLOW GROUNDWATER CONTOURS
FEBRUARY 11, 2000
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO026 MAY 04/2010

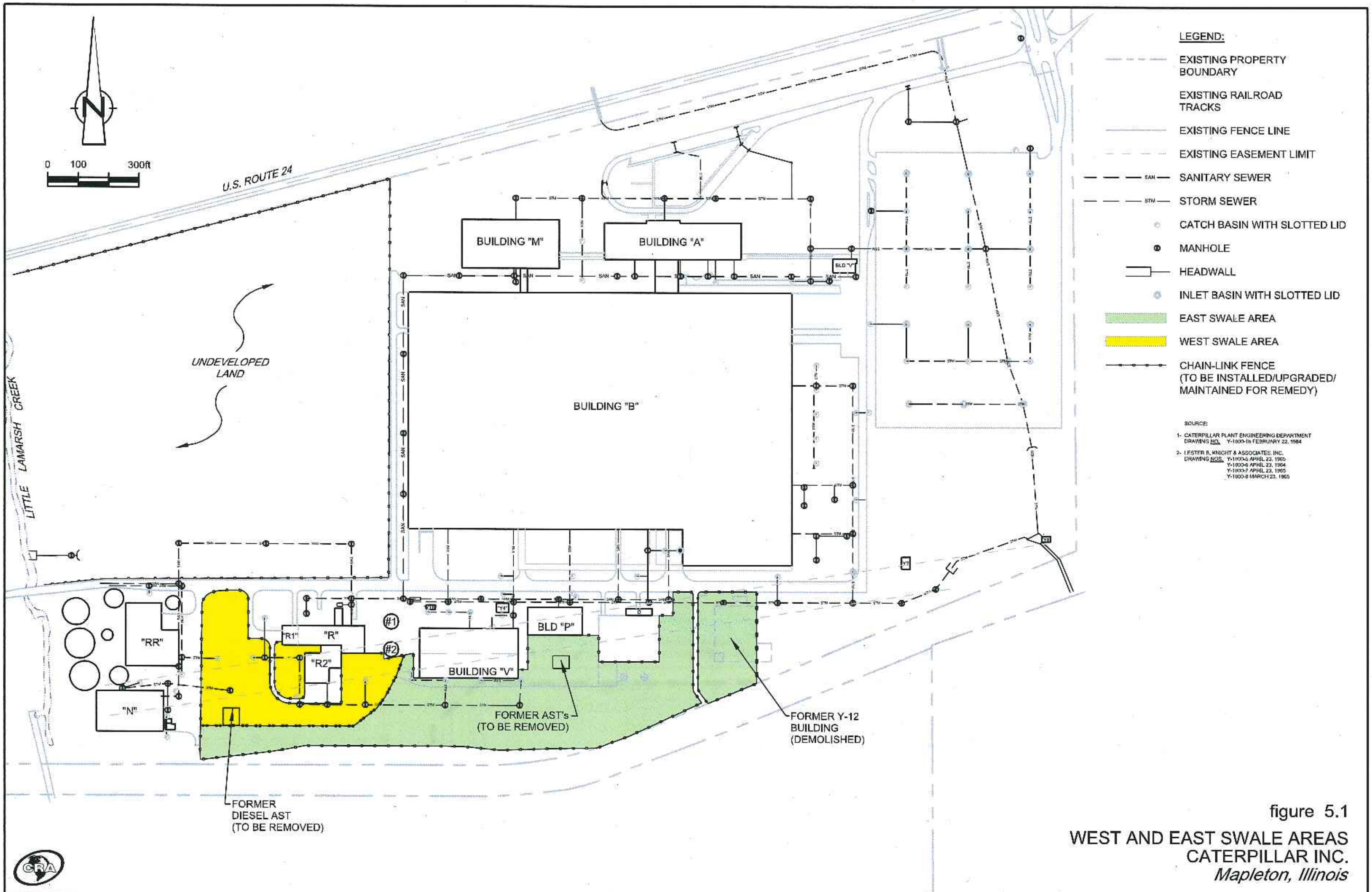
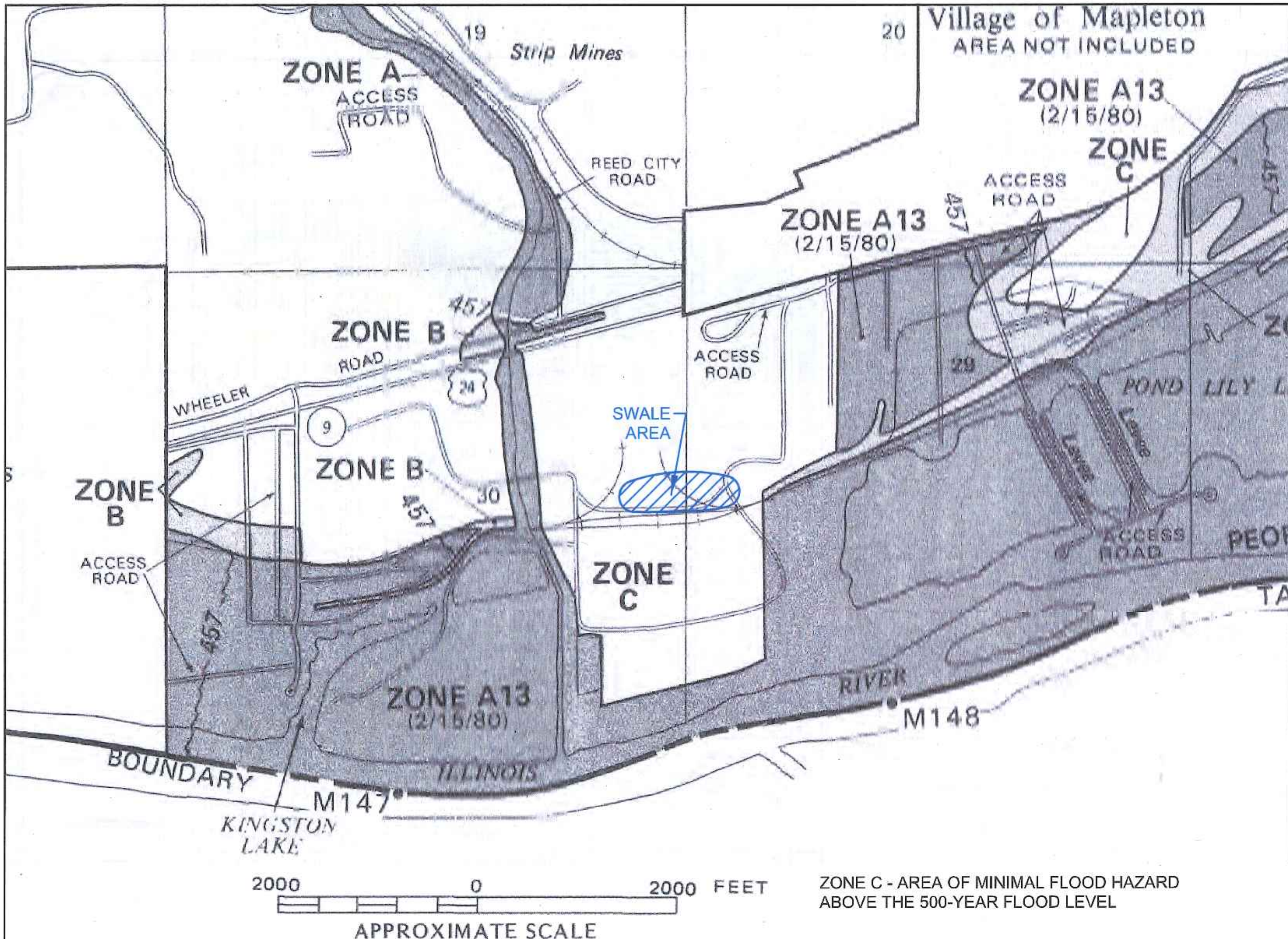


figure 5.1

WEST AND EAST SWALE AREAS
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO027 MAY 04/2010



ZONE C - AREA OF MINIMAL FLOOD HAZARD
ABOVE THE 500-YEAR FLOOD LEVEL

BASE SOURCE:
FIRM
FLOOD INSURANCE RATE MAP
COMMUNITY-PANEL NUMBER 170533 0200 B
MAP REVISED JUNE 1, 1983

figure 6.1

FLOOD INSURANCE RATE MAP
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO032 MAY 04/2010

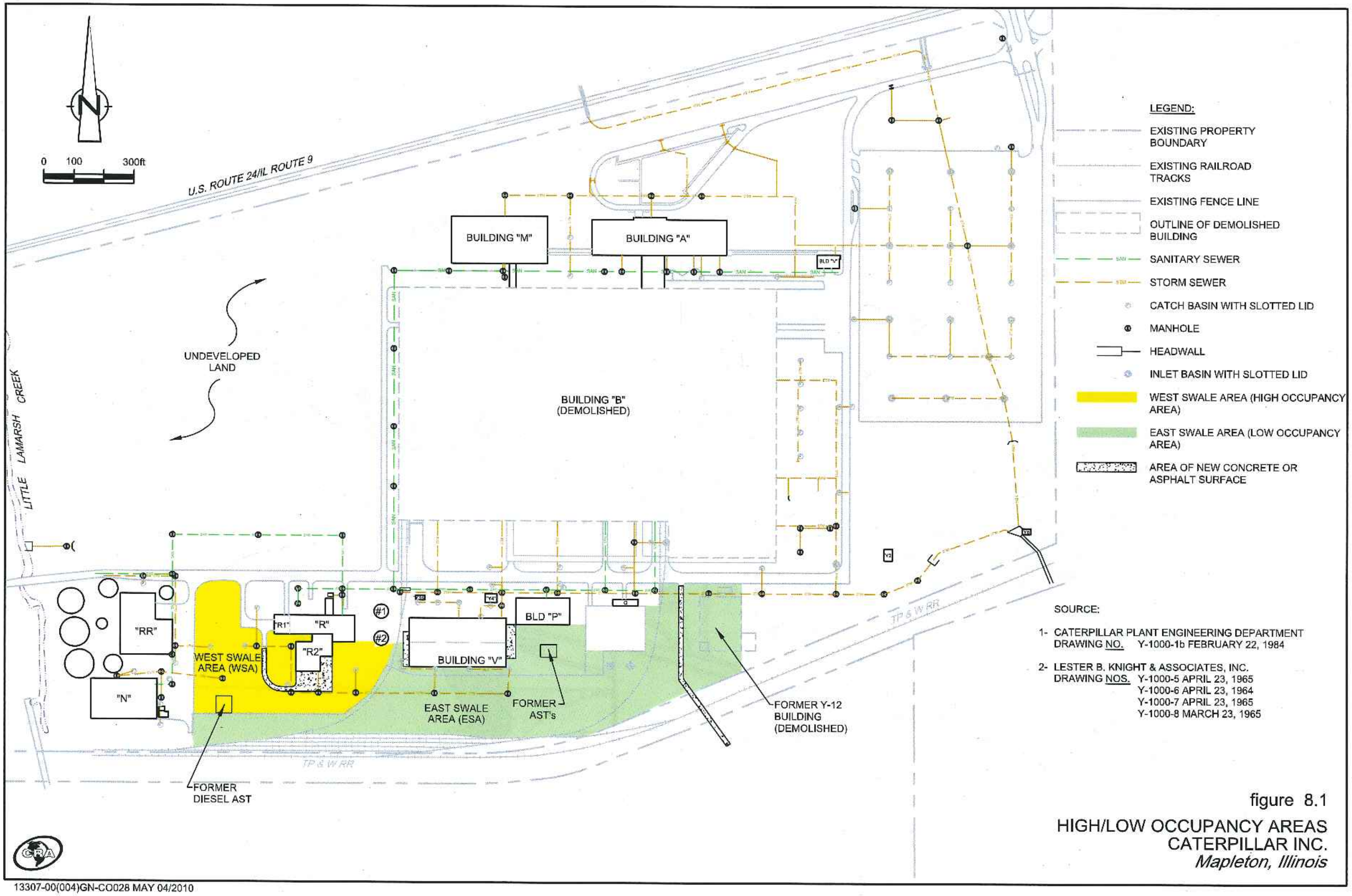


figure 8.1

HIGH/LOW OCCUPANCY AREAS
CATERPILLAR INC.
Mapleton, Illinois

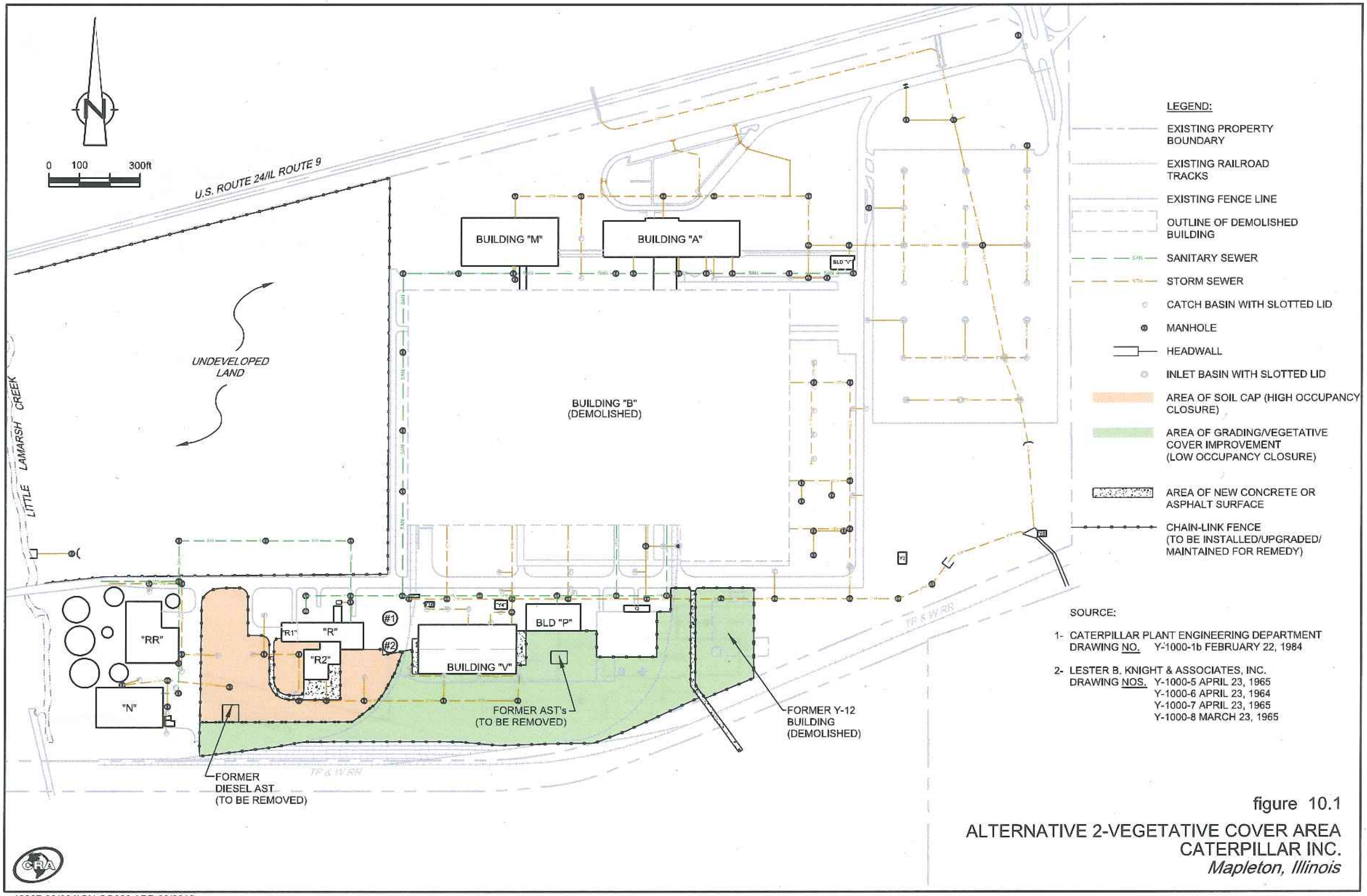


figure 10.1

ALTERNATIVE 2-VEGETATIVE COVER AREA
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO029 APR 20/2010

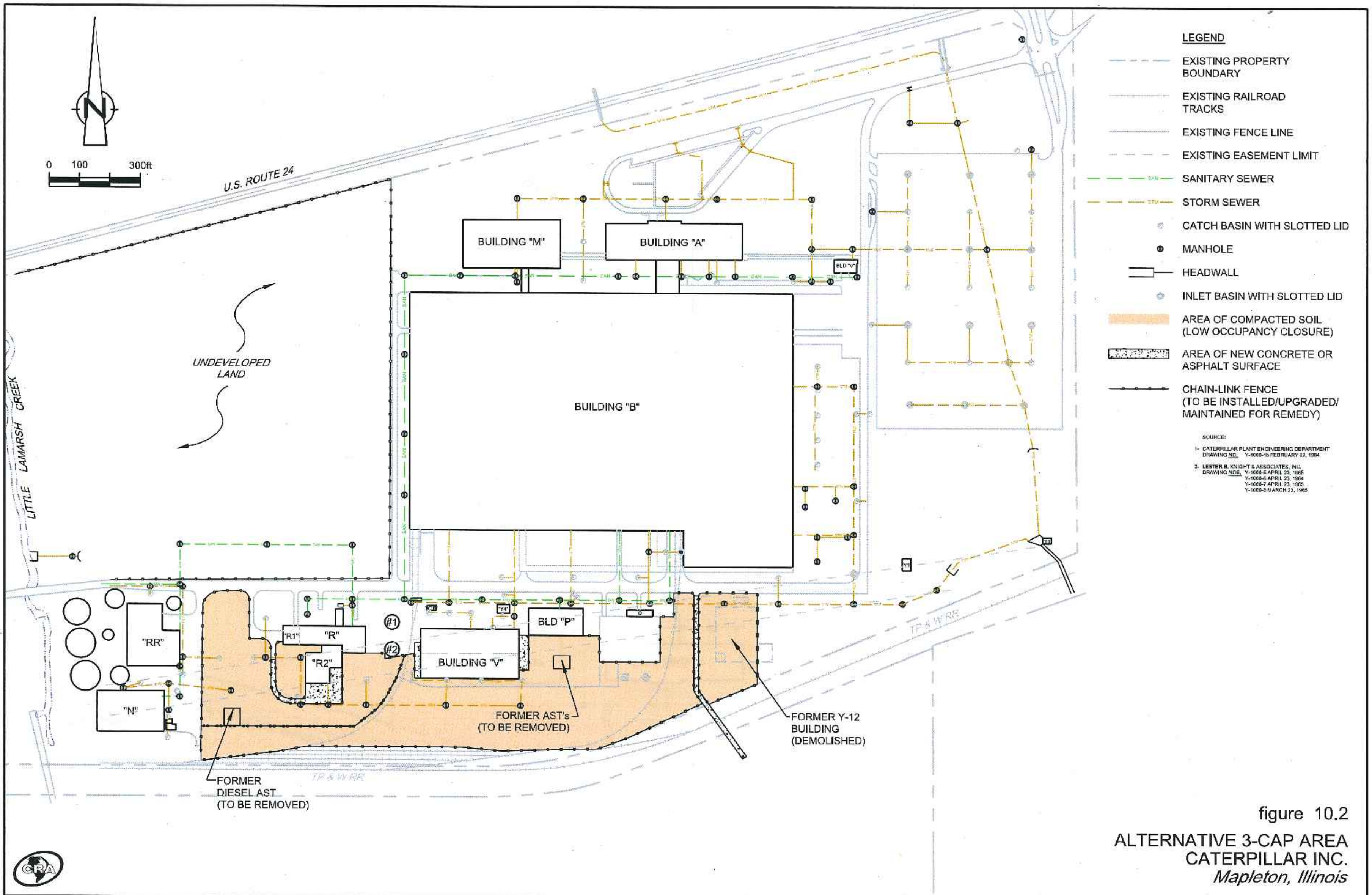


figure 10.2

ALTERNATIVE 3-CAP AREA
CATERPILLAR INC.
Mapleton, Illinois

13307-00(004)GN-CO030 APR 20/2010

TABLE 3.1

**SUMMARY OF SOIL AND GROUNDWATER SAMPLES
COLLECTED BY CRA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS**

Sample Location	*Sample Depth Interval (ft bgs)*	*Sample ID*	*Sample Type*	*Sample Date*	*Analytes*
Phase 1 - December 1998					
B-3	0/2	S-120198-JH-001	Soil	12/01/98	PCBs
B-3	3/5	S-120198-JH-002	Soil	12/01/98	PCBs
B-3	5/7	S-120198-JH-003	Soil	12/01/98	PCBs
B-3	7/9	S-120198-JH-004	Soil	12/01/98	PCBs
B-3	9/11	S-120198-JH-005	Soil	12/01/98	PCBs
B-4	0/2	S-120198-JH-006	Soil	12/01/98	PCBs
B-4	2/4	S-120198-JH-007	Soil	12/01/98	PCBs
B-4	4/6	S-120198-JH-008	Soil	12/01/98	PCBs
B-4	6/8	S-120198-JH-009	Soil	12/01/98	PCBs
B-4	8/10	S-120198-JH-010	Soil	12/01/98	PCBs
B-5	0/2	S-120198-JH-011	Soil	12/01/98	PCBs
B-5	2/4	S-120198-JH-012	Soil	12/01/98	PCBs
B-5	4/6	S-120198-JH-013	Soil	12/01/98	PCBs
B-5	6/8	S-120198-JH-014	Soil	12/01/98	PCBs
B-2	0/2	S-120198-JH-015	Soil	12/01/98	PCBs
B-2	2/4	S-120198-JH-016	Soil	12/01/98	PCBs
B-2	4/6	S-120198-JH-017	Soil	12/01/98	PCBs
B-2	6/8	S-120198-JH-018	Soil	12/01/98	PCBs
B-6	0/2	S-120198-JH-019	Soil	12/01/98	PCBs
B-6	2/4	S-120198-JH-020	Soil	12/01/98	PCBs
B-6	4/6	S-120198-JH-021	Soil	12/01/98	PCBs
B-6	6/8	S-120198-JH-022	Soil	12/01/98	PCBs
B-7	0/2	S-120198-JH-023	Soil	12/01/98	PCBs
B-7	2/4	S-120198-JH-024	Soil	12/01/98	PCBs
B-7	4/6	S-120198-JH-025	Soil	12/01/98	PCBs
B-7	6/8	S-120198-JH-026	Soil	12/01/98	PCBs
B-8	0/2	S-120198-JH-027	Soil	12/01/98	PCBs
B-8	2/4	S-120198-JH-028	Soil	12/01/98	PCBs
B-8	4/5	S-120198-JH-029	Soil	12/01/98	PCBs
B-8	5/7	S-120198-JH-030	Soil	12/01/98	PCBs
B-8	7/9	S-120198-JH-031	Soil	12/01/98	PCBs

TABLE 3.1

SUMMARY OF SOIL AND GROUNDWATER SAMPLES
COLLECTED BY CRA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location	*Sample Depth Interval (ft bgs)*	*Sample ID*	*Sample Type*	*Sample Date*	*Analytes*
Phase 1 - December 1998 (continued)					
B-1	0/2	S-120198-JH-032	Soil	12/01/98	PCBs
B-1	2/4	S-120198-JH-033	Soil	12/01/98	PCBs
B-1	4/6	S-120198-JH-034	Soil	12/01/98	PCBs
B-1	6/8	S-120198-JH-035	Soil	12/01/98	PCBs
B-10	0/2	S-120298-JH-036	Soil	12/02/98	PCBs
B-10	2/4	S-120298-JH-037	Soil	12/02/98	PCBs
B-10	4/6	S-120298-JH-038	Soil	12/02/98	PCBs
B-10	6/8	S-120298-JH-039	Soil	12/02/98	PCBs
B-13	0/2	S-120298-JH-040	Soil	12/02/98	PCBs
B-13	2/4	S-120298-JH-041	Soil	12/02/98	PCBs
B-13	4/6	S-120298-JH-042	Soil	12/02/98	PCBs
B-13	6/8	S-120298-JH-043	Soil	12/02/98	PCBs
B-14	0/2	S-120298-JH-044	Soil	12/02/98	PCBs
B-14	2/4	S-120298-JH-045	Soil	12/02/98	PCBs
B-14	4/6	S-120298-JH-046	Soil	12/02/98	PCBs
B-14	6/8	S-120298-JH-047	Soil	12/02/98	PCBs
B-14	8/10	S-120298-JH-048	Soil	12/02/98	PCBs
B-12	0/2	S-120298-JH-049	Soil	12/02/98	PCBs
B-12	2/4	S-120298-JH-050	Soil	12/02/98	PCBs
B-12	4/6	S-120298-JH-051	Soil	12/02/98	PCBs
B-12	6/8	S-120298-JH-052	Soil	12/02/98	PCBs
B-11	0/2	S-120298-JH-053	Soil	12/02/98	PCBs
B-11	2/4	S-120298-JH-054	Soil	12/02/98	PCBs
B-11	4/6	S-120298-JH-055	Soil	12/02/98	PCBs
B-11	6/8	S-120298-JH-056	Soil	12/02/98	PCBs
B-11	8/9	S-120298-JH-057	Soil	12/02/98	PCBs
B-9	0/2	S-120298-JH-058	Soil	12/02/98	PCBs
B-9	2/4	S-120298-JH-059	Soil	12/02/98	PCBs
B-9	4/6	S-120298-JH-060	Soil	12/02/98	PCBs
B-9	6/8	S-120298-JH-061	Soil	12/02/98	PCBs

TABLE 3.1

SUMMARY OF SOIL AND GROUNDWATER SAMPLES
COLLECTED BY CRA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location	*Sample Depth Interval (ft bgs)*	*Sample ID*	*Sample Type*	*Sample Date*	*Analytes*
Phase 2 - February 1999					
B-18	0/2	S-022399-JH-062	Soil	02/23/99	PCBs
B-18	2/4	S-022399-JH-063	Soil	02/23/99	PCBs
B-18	4/6	S-022399-JH-064	Soil	02/23/99	PCBs
B-18	6/8	S-022399-JH-065	Soil	02/23/99	PCBs
B-19	0/2	S-022399-JH-066	Soil	02/23/99	PCBs
B-19	2/4	S-022399-JH-067	Soil	02/23/99	PCBs
B-19	4/6	S-022399-JH-068	Soil	02/23/99	PCBs
B-19	6/8	S-022399-JH-069	Soil	02/23/99	PCBs
B-16	0/2	S-022399-JH-070	Soil	02/23/99	PCBs
B-16	2/4	S-022399-JH-071	Soil	02/23/99	PCBs
B-16	4/6	S-022399-JH-072	Soil	02/23/99	PCBs
B-16	6/8	S-022399-JH-073	Soil	02/23/99	PCBs
B-17	0/2	S-022399-JH-074	Soil	02/23/99	PCBs
B-17	2/4	S-022399-JH-075	Soil	02/23/99	PCBs
B-17	4/6	S-022399-JH-076	Soil	02/23/99	PCBs
B-17	6/8	S-022399-JH-077	Soil	02/23/99	PCBs
B-15	0/2	S-022399-JH-078	Soil	02/23/99	PCBs
B-15	2/4	S-022399-JH-079	Soil	02/23/99	PCBs
B-15	4/6	S-022399-JH-080	Soil	02/23/99	PCBs
B-15	6/8	S-022399-JH-081	Soil	02/23/99	PCBs
Phase 3 - September 1999					
B-20	0/2	S-091399-JH-082	Soil	09/13/99	PCBs
B-20	2/4	S-091399-JH-083	Soil	09/13/99	PCBs
B-20	4/6	S-091399-JH-084	Soil	09/13/99	PCBs
B-20	6/8	S-091399-JH-085	Soil	09/13/99	PCBs
B-21	0/2	S-091399-JH-086	Soil	09/13/99	PCBs
B-21	2/4	S-091399-JH-087	Soil	09/13/99	PCBs
B-21	4/6	S-091399-JH-088	Soil	09/13/99	PCBs
B-21	6/8	S-091399-JH-089	Soil	09/13/99	PCBs

TABLE 3.1

**SUMMARY OF SOIL AND GROUNDWATER SAMPLES
COLLECTED BY CRA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS**

Sample Location	*Sample Depth Interval (ft bgs)*	*Sample ID*	*Sample Type*	*Sample Date*	*Analytes*
Phase 3 - September 1999 (continued)					
B-26	0/2	S-091499-JH-106	Soil	09/14/99	PCBs
B-26	2/4	S-091499-JH-107	Soil	09/14/99	PCBs
B-26	4/6	S-091499-JH-108	Soil	09/14/99	PCBs
B-26	6/8	S-091499-JH-109	Soil	09/14/99	PCBs
Phase 4 - March 2005					
B-60	0/2	S-030105-JH-001	Soil	03/01/05	PCBs
B-60	2/4	S-030105-JH-002	Soil	03/01/05	PCBs
B-60	4/6	S-030105-JH-003	Soil	03/01/05	PCBs
B-60	6/7	S-030105-JH-004	Soil	03/01/05	PCBs
B-59	0/2	S-030105-JH-005	Soil	03/01/05	PCBs
B-59	2/4	S-030105-JH-006	Soil	03/01/05	PCBs
B-59	4/6	S-030105-JH-007	Soil	03/01/05	PCBs
B-58	0/2	S-030105-JH-008	Soil	03/01/05	PCBs
B-58	2/4	S-030105-JH-009	Soil	03/01/05	PCBs
B-61	0/2	S-030105-JH-010	Soil	03/01/05	PCBs
B-61	2/4	S-030105-JH-011	Soil	03/01/05	PCBs
B-61	4/6	S-030105-JH-012	Soil	03/01/05	PCBs
B-61	6/7	S-030105-JH-013	Soil	03/01/05	PCBs
B-62	0/2	S-030105-JH-014	Soil	03/01/05	PCBs
B-62	2/4	S-030105-JH-015	Soil	03/01/05	PCBs
B-62	4/6	S-030105-JH-016	Soil	03/01/05	PCBs
B-62	6/8	S-030105-JH-017	Soil	03/01/05	PCBs
B-62	8/10	S-030105-JH-018	Soil	03/01/05	PCBs
B-64	0/2	S-030105-JH-019	Soil	03/01/05	PCBs
B-64	2/4	S-030105-JH-020	Soil	03/01/05	PCBs
B-64	4/6	S-030105-JH-021	Soil	03/01/05	PCBs
B-64	6/8	S-030105-JH-022	Soil	03/01/05	PCBs
B-64	8/10	S-030105-JH-023	Soil	03/01/05	PCBs

TABLE 3.1

SUMMARY OF SOIL AND GROUNDWATER SAMPLES
COLLECTED BY CRA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location	*Sample Depth Interval (ft bgs)*	*Sample ID*	*Sample Type*	*Sample Date*	*Analytes*
Phase 4 - March 2005 (continued)					
B-63	0/2	S-030105-JH-024	Soil	03/01/05	PCBs
B-63	2/4	S-030105-JH-025	Soil	03/01/05	PCBs
B-63	4/6	S-030105-JH-026	Soil	03/01/05	PCBs
B-65	0/2	S-030105-JH-027	Soil	03/01/05	PCBs
B-65	2/4	S-030105-JH-028	Soil	03/01/05	PCBs
B-65	4/6	S-030105-JH-029	Soil	03/01/05	PCBs
B-65	6/7	S-030105-JH-030	Soil	03/01/05	PCBs
B-66	0/2	S-030105-JH-031	Soil	03/01/05	PCBs
B-66	2/4	S-030105-JH-032	Soil	03/01/05	PCBs
B-57	0/2	S-030205-JH-033	Soil	03/02/05	PCBs
B-57	2/4	S-030205-JH-034	Soil	03/02/05	PCBs
B-57	4/6	S-030205-JH-035	Soil	03/02/05	PCBs
B-57	6/7	S-030205-JH-036	Soil	03/02/05	PCBs
B-56	0/2	S-030205-JH-037	Soil	03/02/05	PCBs
B-56	2/4	S-030205-JH-038	Soil	03/02/05	PCBs
B-56	4/6	S-030205-JH-039	Soil	03/02/05	PCBs
B-56	6/7	S-030205-JH-040	Soil	03/02/05	PCBs
B-55	0/2	S-030205-JH-041	Soil	03/02/05	PCBs
B-55	2/4	S-030205-JH-042	Soil	03/02/05	PCBs
B-55	4/6	S-030205-JH-043	Soil	03/02/05	PCBs
B-55	6/7	S-030205-JH-044	Soil	03/02/05	PCBs
B-54	0/2	S-030205-JH-045	Soil	03/02/05	PCBs
B-54	2/4	S-030205-JH-046	Soil	03/02/05	PCBs
B-54	4/6	S-030205-JH-047	Soil	03/02/05	PCBs
B-54	6/7	S-030205-JH-048	Soil	03/02/05	PCBs
B-53	0/2	S-030205-JH-049	Soil	03/02/05	PCBs
B-53	2/4	S-030205-JH-050	Soil	03/02/05	PCBs
B-53	4/6	S-030205-JH-051	Soil	03/02/05	PCBs
B-53	6/7	S-030205-JH-052	Soil	03/02/05	PCBs

TABLE 3.1

**SUMMARY OF SOIL AND GROUNDWATER SAMPLES
COLLECTED BY CRA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS**

Sample Location	*Sample Depth Interval (ft bgs)*	*Sample ID*	*Sample Type*	*Sample Date*	*Analytes*
Groundwater - December 1999 - January 2000					
MW-99C	- -	GW-121699-WP-001	Groundwater	12/16/99	PCBs
MW-99C	- -	GW-121699-WP-002	Groundwater	12/16/99	PCBs (Duplicate)
MW-99A	- -	GW-121699-WP-003	Groundwater	12/16/99	PCBs
MW-99B	- -	GW-010600-JH-001	Groundwater	01/06/00	PCBs

Notes:
ft bgs - feet below ground surface
PCBs - polychlorinated biphenyls

TABLE 3.2

SUMMARY OF WELL DEVELOPMENT PARAMETERS
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Well Number	*Date Conducted*	*Depth to Water (ft BTOC)*	*Well Volume (gallons)*	*Volume Removed (gallons)*	*pH (Standard Units)*	*Conductivity (µS/cm)*	*Temperature (°C)*	*Appearance*
MW-99A	11/16/1999	14.01	0.95	2.5	7.10	842	16.0	very turbid, gray
				5.0	7.18	888	16.6	very turbid, gray
				7.5	7.23	870	16.3	cloudy, gray
				10.0	7.25	880	16.4	cloudy, gray
				12.5	7.33	888	15.8	slightly cloudy, gray
				15.0	7.29	885	16.3	slightly cloudy, gray
				17.5	7.29	885	16.2	slightly cloudy, gray
				20.0	7.25	884	16.3	slightly cloudy, gray
				22.5	7.29	887	16.3	slightly cloudy, gray
				25.0	7.30	885	16.3	very slightly cloudy, gray
				27.5	7.27	880	16.3	very slightly cloudy, gray
				30.0	7.26	875	16.3	clear
				32.5	7.31	870	16.3	clear
				35.0	7.26	868	16.3	clear
MW-99B	11/16/1999	Dry	-	-	-	-	-	
	12/16/1999	18.72	0.5	0.5	6.51	1,460	7.7	clear
								purged dry at 0.6 gallons
MW-99c	11/16/1999	16.95	0.5	2.5	7.50	778	15.4	very turbid, gray
		Slow recovery		5	7.38	772	15.4	cloudy, gray
				6	7.14	747	16.4	clear
				7	7.20	756	16.4	clear
				8	7.22	758	16.4	clear
				9	7.23	757	16.3	clear
				10	7.22	759	16.3	clear

ft BTOC - feet below top of casing
µS/cm - microsiemens per centimeter
°C - degrees Celcius

TABLE 3.3

SUMMARY OF GROUNDWATER ELEVATION DATA
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

		November 19, 1999		*December 16, 1999*		*February 11, 2000*	
Well Identification	*Top of Casing Elevation (ft AMSL)*	*Depth to Water (ft BTOC)*	*Groundwater Elevation (ft AMSL)*	*Depth to Water (ft BTOC)*	*Groundwater Elevation (ft AMSL)*	*Depth to Water (ft BTOC)*	*Groundwater Elevation (ft AMSL)*
G-101S	460.52	12.00	448.52	12.43	448.09	13.02	447.50
G-102S	449.59	7.86	441.73	6.89	442.70	6.79	442.80
P-109	451.96	8.43	443.53	8.48	443.48	8.86	443.10
MW-99A	462.98	14.06	451.17	14.31	450.92	14.83	450.40
MW-99B	465.23	Dry	NA	18.72	442.96	18.91	442.77
MW-99C	461.68	13.35	448.33	13.45	448.23	13.86	447.82

Notes:
ft AMSL - feet above mean sea level
ft BTOC - feet below top of casing
NA - not applicable

TABLE 4.1

SOIL ANALYTICAL RESULTS
COLLECTED BY CATERPILLAR
CATERPILLAR DRUM STORAGE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

K-1			*K-3*			*M-3*			*P-3*			*Q-29*		
Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*
0 - 1	--		0 - 1	--		0 - 1	--		0 - 1	--		0 - 1	--	
1 - 2	--		1 - 2	--		1 - 2	--		1 - 2	--		1 - 2	--	
2 - 3	13		2 - 3	--		2 - 3	--		2 - 3	--		2 - 3	--	
3 - 4	--		3 - 4	29		3 - 4	--		3 - 4	--		3 - 4	33	
4 - 5	--		4 - 5	--		4 - 5	--		4 - 5	--		4 - 5	--	
5 - 6	25		5 - 6	--		5 - 6	--		5 - 6	--		5 - 6	--	
6 - 7	--		6 - 7	23		6 - 7	--		6 - 7	--		6 - 7	--	
7 - 8	--		7 - 8	--		7 - 8	--		7 - 8	--		7 - 8	--	
8 - 9	--		8 - 9	--	Clay @ 8.7	8 - 9	--		8 - 9	--		8 - 9	--	
9 - 10	--		9 - 10	--		9 - 10	--	Clay @ 9.8	9 - 10	--		9 - 10	--	
10 - 11	--		10 - 11	--		10 - 11	--		10 - 11	20		10 - 11	--	
11 - 12	--		11 - 12	--		11 - 12	--		11 - 12	--	Clay @ 11.1	11 - 12	20	Clay @ 11.7
12 - 13	--		12 - 13	--		12 - 13	--		12 - 13	--		12 - 13	--	

Q-34			*T-32*			*T-36*			*T-42*			*T-46*		
Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*
0 - 1	--		0 - 1	--		0 - 1	--		0 - 1	--		0 - 1	--	
1 - 2	--		1 - 2	--		1 - 2	--		1 - 2	--		1 - 2	--	
2 - 3	--		2 - 3	--		2 - 3	--		2 - 3	--		2 - 3	--	
3 - 4	--		3 - 4	--		3 - 4	42		3 - 4	--		3 - 4	--	
4 - 5	--		4 - 5	--		4 - 5	14		4 - 5	--		4 - 5	110	
5 - 6	--		5 - 6	--		5 - 6	--		5 - 6	--		5 - 6	--	
6 - 7	--		6 - 7	--		6 - 7	--		6 - 7	--		6 - 7	--	
7 - 8	--		7 - 8	--		7 - 8	--		7 - 8	--		7 - 8	--	
8 - 9	--		8 - 9	--		8 - 9	--		8 - 9	--		8 - 9	--	
9 - 10	--		9 - 10	--		9 - 10	--		9 - 10	--		9 - 10	--	
10 - 11	--		10 - 11	--		10 - 11	--		10 - 11	35		10 - 11	45	Clay @ 10.8
11 - 12	--		11 - 12	19	Clay @ 12.5	11 - 12	48	Clay @ 11.5	11 - 12	--	Clay @ 11.2	11 - 12	--	
12 - 13	3	Clay @ 12.4	12 - 13	--		12 - 13	--		12 - 13	--		12 - 13	--	

TABLE 4.1

SOIL ANALYTICAL RESULTS
COLLECTED BY CATERPILLAR
CATERPILLAR DRUM STORAGE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

U-50

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	220	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	290	Clay @ 10.8
11 - 12	--	
12 - 13	--	

W-5

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	23	Clay @ 12.5

W-9

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	<8	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	Clay @ 12.2

W-30

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	Clay @ 11.5
12 - 13	--	

W-39

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	120	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	5.4	Clay @ 11.3
12 - 13	--	

Y-7

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	??	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	17	
10 - 11	--	
11 - 12	--	Clay @ 11.2
12 - 13	--	

Y-19

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	49	Clay @ 11.6
12 - 13		

AA-7

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	36	
10 - 11	--	
11 - 12	--	Clay @ 11.4
12 - 13	--	

AA-13

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	Sand heaving,
1 - 2	--	couldn't
2 - 3	--	reach clay
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

CC-3

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	4.9	Clay @ 11.5
12 - 13	--	

TABLE 4.1

SOIL ANALYTICAL RESULTS
COLLECTED BY CATERPILLAR
CATERPILLAR DRUM STORAGE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

CC-7

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	18	Clay @ 11.3
12 - 13	--	

K-13

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	4.2	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

K-13A

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	24	
6 - 7	28	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

K-13B

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	63	not def. depth of clay?
6 - 7	63	
7 - 8	150	
8 - 9	150	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

K-13C

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	42	
6 - 7	41	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

R-19

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	0.64	
3 - 4	9.8	
4 - 5	14	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

R-19A

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4		
4 - 5	340	not def clay?
5 - 6	48	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

R-19B

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	87	
4 - 5	17	not def clay?
5 - 6	55	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

R-19C

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	67	
4 - 5	39	clay?
5 - 6	160	
6 - 7	160	
7 - 8	11	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

R-19D

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	clay?
5 - 6	38	
6 - 7	110	
7 - 8	44	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

TABLE 4.1

SOIL ANALYTICAL RESULTS
COLLECTED BY CATERPILLAR
CATERPILLAR DRUM STORAGE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

R-19E

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	28	
4 - 5	160	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	--	
12 - 13	--	

not def clay?

H-11

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	37	
7 - 8	--	
8 - 9	0.4	
9 - 10	--	Clay @ 8.7
10 - 11	--	
11 - 12	--	
12 - 13	--	

H-15

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	58	
7 - 8	--	
8 - 9	--	
9 - 10	1.1	Clay @ 9.0
10 - 11	--	
11 - 12	--	
12 - 13	--	

K-9

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	68	
6 - 7	--	
7 - 8	190	
8 - 9	200	
9 - 10	--	Clay @ 9.2
10 - 11	--	
11 - 12	--	
12 - 13	--	

K-17

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	71	
8 - 9	--	
9 - 10	0.5	
10 - 11	--	Clay @ 10.0
11 - 12	--	
12 - 13	--	

L-10

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	59	
9 - 10	--	Clay @ 9.7
10 - 11	--	
11 - 12	--	
12 - 13	--	

L-14

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	61	
8 - 9	--	
9 - 10	100	
10 - 11	--	Clay @ 10.5
11 - 12	--	
12 - 13	--	

M-7

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	17	
6 - 7	--	
7 - 8	29	
8 - 9	--	
9 - 10	320	
10 - 11	--	Clay @ 10.7
11 - 12	--	
12 - 13	--	

M-11

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	55	
7 - 8	--	
8 - 9	--	
9 - 10	20	
10 - 11	--	Clay @ 10.2
11 - 12	--	
12 - 13	--	

M-15

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	38	
9 - 10	--	Clay @ 9.5
10 - 11	--	
11 - 12	--	
12 - 13	--	

TABLE 4.1

SOIL ANALYTICAL RESULTS
COLLECTED BY CATERPILLAR
CATERPILLAR DRUM STORAGE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

M-19

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	66	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	51	
10 - 11	--	Clay @ 10.7
11 - 12	--	
12 - 13	--	

not def

P-9

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	26	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	31	
11 - 12	--	Clay @ 11.5
12 - 13	--	

P-15

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	100	
5 - 6	--	
6 - 7	72	
7 - 8	--	
8 - 9	110	
9 - 10	--	
10 - 11	59	
11 - 12	--	Clay @ 11.2
12 - 13	--	

not def

P-19

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	200	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	3.4	
9 - 10	--	
10 - 11	140	
11 - 12	--	Clay @ 11.2
12 - 13	--	

not def

P-23

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	160	
3 - 4	--	
4 - 5	220	
5 - 6	--	
6 - 7	84	
7 - 8	--	
8 - 9	43	
9 - 10	--	
10 - 11	38	
11 - 12	--	Clay @ 11.0
12 - 13	--	

R-13

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	22	
12 - 13	--	Clay @ 12.0

R24

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	--	
9 - 10	--	
10 - 11	--	
11 - 12	33	
12 - 13	--	Clay @ 12.2

T-28

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	16	
3 - 4	--	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	35	
9 - 10	--	
10 - 11	45	
11 - 12	--	Clay @ 11.7
12 - 13	--	

U-14

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	150	
4 - 5	--	
5 - 6	--	
6 - 7	--	
7 - 8	--	
8 - 9	61	
9 - 10	--	
10 - 11	48	
11 - 12	--	Clay @ 11.2
12 - 13	--	

U-22

Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*
0 - 1	--	
1 - 2	--	
2 - 3	--	
3 - 4	28	
4 - 5	--	
5 - 6	28	
6 - 7	--	
7 - 8	--	
8 - 9	35	
9 - 10	300	
10 - 11	--	
11 - 12	73	
12 - 13	--	Clay @ 12.5

not def

TABLE 4.1

SOIL ANALYTICAL RESULTS
COLLECTED BY CATERPILLAR
CATERPILLAR DRUM STORAGE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

W-13			W-25			EX-1		
Depth Interval (ft bgs)	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*	*Depth Interval (ft bgs)*	*PCB Result (mg/kg)*	*Observation*
0 - 1	--		0 - 1	--		0 - 1	--	
1 - 2	--		1 - 2	--		1 - 2	--	
2 - 3	--		2 - 3	19		2 - 3	--	
3 - 4	82		3 - 4	--		3 - 4	--	
4 - 5	--		4 - 5	--		4 - 5	--	
5 - 6	--		5 - 6	--		5 - 6	<DL	
6 - 7	47		6 - 7	36		6 - 7	--	
7 - 8	--		7 - 8	--		7 - 8	--	
8 - 9	--		8 - 9	--		8 - 9	--	
9 - 10	--		9 - 10	--		9 - 10	--	Clay @ 9.0
10 - 11	46		10 - 11	47		10 - 11	--	
11 - 12	--	Clay @ 11.7	11 - 12	--	Clay @ 11.5	11 - 12	--	
12 - 13	--		12 - 13	--		12 - 13	--	

Notes:
ft bgs - feet below ground surface
mg/kg - milligrams per kilogram
<DL - less than detection limit

TABLE 4.2

SUMMARY OF CRA SOIL ANALYTICAL RESULTS
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location		B-1	B-1	B-1	B-1	B-2	B-2	B-2	B-2	B-3	B-3	B-3
Sample Identification		S-120198-JH-032	S-120198-JH-033	S-120198-JH-034	S-120198-JH-035	S-120198-JH-015	S-120198-JH-016	S-120198-JH-017	S-120198-JH-018	S-120198-JH-001	S-120198-JH-002	S-120198-JH-003
Sample Date		12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998
Sample Depth (ft bgs)	*Units*	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)	(3-5)	(5-7)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.37)	ND(0.2)	ND(3.9)	ND(4.3)	ND(0.035)	ND(0.036)	ND(75)	ND(0.39)	ND(0.35)	ND(0.37)	ND(0.036)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.37)	ND(0.2)	ND(3.9)	ND(4.3)	ND(0.035)	ND(0.036)	ND(75)	ND(0.39)	ND(0.35)	ND(0.37)	ND(0.036)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.37)	ND(0.2)	ND(3.9)	ND(4.3)	ND(0.035)	ND(0.036)	ND(75)	ND(0.39)	ND(0.35)	ND(0.37)	ND(0.036)
Aroclor-1242 (PCB-1242)	mg/kg	1	ND(0.2)	64	39	ND(0.035)	ND(0.036)	570	1.2	ND(0.35)	1.8	ND(0.036)
Aroclor-1248 (PCB-1248)	mg/kg	ND(0.37)	ND(0.2)	ND(3.9)	ND(4.3)	ND(0.035)	ND(0.036)	ND(75)	ND(0.39)	2.4	ND(0.37)	0.48
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.37)	ND(0.2)	ND(3.9)	ND(4.3)	ND(0.035)	ND(0.036)	ND(75)	ND(0.39)	ND(0.35)	ND(0.37)	ND(0.036)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.37)	ND(0.2)	ND(3.9)	ND(4.3)	ND(0.035)	ND(0.036)	ND(75)	ND(0.39)	ND(0.35)	ND(0.37)	ND(0.036)

Sample Location		B-3	B-3	B-4	B-4	B-4	B-4	B-4	B-5	B-5	B-5	B-5
Sample Identification		S-120198-JH-004	S-120198-JH-005	S-120198-JH-006	S-120198-JH-007	S-120198-JH-008	S-120198-JH-009	S-120198-JH-010	S-120198-JH-011	S-120198-JH-012	S-120198-JH-013	S-120198-JH-014
Sample Date		12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998
Sample Depth (ft bgs)	*Units*	(7-9)	(9-11)	(0-2)	(2-4)	(4-6)	(6-8)	(8-10)	(0-2)	(2-4)	(4-6)	(6-8)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.034)	ND(0.043)	ND(0.36)	ND(0.036)	ND(0.036)	ND(0.36)	ND(0.036)	ND(0.034)	ND(0.35)	ND(0.35)	ND(3.8)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.034)	ND(0.043)	ND(0.36)	ND(0.036)	ND(0.036)	ND(0.36)	ND(0.036)	ND(0.034)	ND(0.35)	ND(0.35)	ND(3.8)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.034)	ND(0.043)	ND(0.36)	ND(0.036)	ND(0.036)	ND(0.36)	ND(0.036)	ND(0.034)	ND(0.35)	ND(0.35)	ND(3.8)
Aroclor-1242 (PCB-1242)	mg/kg	ND(0.034)	ND(0.043)	3.4	ND(0.036)	ND(0.036)	ND(0.36)	ND(0.036)	ND(0.034)	ND(0.35)	ND(0.35)	21
Aroclor-1248 (PCB-1248)	mg/kg	ND(0.034)	ND(0.043)	ND(0.36)	ND(0.036)	ND(0.036)	1.2	ND(0.036)	0.22	3.3	1.4	ND(3.8)
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.034)	ND(0.043)	ND(0.36)	ND(0.036)	ND(0.036)	ND(0.36)	ND(0.036)	ND(0.034)	ND(0.35)	ND(0.35)	ND(3.8)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.034)	ND(0.043)	ND(0.36)	ND(0.036)	ND(0.036)	ND(0.36)	ND(0.036)	ND(0.034)	ND(0.35)	ND(0.35)	ND(3.8)

Sample Location		B-6	B-6	B-6	B-6	B-7	B-7	B-7	B-7	B-8	B-8	B-8
Sample Identification		S-120198-JH-019	S-120198-JH-020	S-120198-JH-021	S-120198-JH-022	S-120198-JH-023	S-120198-JH-024	S-120198-JH-025	S-120198-JH-026	S-120198-JH-027	S-120198-JH-028	S-120198-JH-029
Sample Date		12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998	12/1/1998
Sample Depth (ft bgs)	*Units*	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)	(2-4)	(4-5)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(1.1)	ND(0.36)	ND(0.35)	ND(3.8)	ND(3.7)	ND(34)	ND(3.8)	ND(39)	ND(1.8)	ND(3.7)	120
Aroclor-1221 (PCB-1221)	mg/kg	ND(1.1)	ND(0.36)	ND(0.35)	ND(3.8)	ND(3.7)	ND(34)	ND(3.8)	ND(39)	ND(1.8)	ND(3.7)	ND(36)
Aroclor-1232 (PCB-1232)	mg/kg	ND(1.1)	ND(0.36)	ND(0.35)	ND(3.8)	ND(3.7)	ND(34)	ND(3.8)	ND(39)	ND(1.8)	ND(3.7)	ND(36)
Aroclor-1242 (PCB-1242)	mg/kg	6.7	ND(0.36)	ND(0.35)	57	14	260	17	92	ND(1.8)	6.8	ND(36)
Aroclor-1248 (PCB-1248)	mg/kg	ND(1.1)	1.5	1.8	ND(3.8)	ND(3.7)	ND(34)	ND(3.8)	ND(39)	6.1	ND(3.7)	ND(36)
Aroclor-1254 (PCB-1254)	mg/kg	ND(1.1)	ND(0.36)	ND(0.35)	ND(3.8)	ND(3.7)	ND(34)	ND(3.8)	ND(39)	ND(1.8)	ND(3.7)	ND(36)
Aroclor-1260 (PCB-1260)	mg/kg	ND(1.1)	ND(0.36)	ND(0.35)	ND(3.8)	ND(3.7)	ND(34)	ND(3.8)	ND(39)	ND(1.8)	ND(3.7)	ND(36)

TABLE 4.2

SUMMARY OF CRA SOIL ANALYTICAL RESULTS
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location		B-8	B-8	B-9	B-9	B-9	B-9	B-10	B-10	B-10	B-10	B-11
Sample Identification		S-120198-JH-030	S-120198-JH-031	S-120298-JH-058	S-120298-JH-059	S-120298-JH-060	S-120298-JH-061	S-120298-JH-036	S-120298-JH-037	S-120298-JH-038	S-120298-JH-039	S-120298-JH-053
Sample Date		12/1/1998	12/1/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998
Sample Depth (ft bgs)	*Units*	(5-7)	(7-9)	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(38)	ND(3.7)	ND(0.036)	29	73	700	0.43	58	7.7	ND(3.6)	ND(0.36)
Aroclor-1221 (PCB-1221)	mg/kg	ND(38)	ND(3.7)	ND(0.036)	ND(3.6)	ND(18)	ND(180)	ND(0.18)	ND(36)	ND(3.6)	ND(3.6)	ND(0.36)
Aroclor-1232 (PCB-1232)	mg/kg	ND(38)	ND(3.7)	ND(0.036)	ND(3.6)	ND(18)	ND(180)	ND(0.18)	ND(36)	ND(3.6)	ND(3.6)	ND(0.36)
Aroclor-1242 (PCB-1242)	mg/kg	130	35	ND(0.036)	ND(3.6)	ND(18)	ND(180)	ND(0.18)	ND(36)	ND(3.6)	10	ND(0.36)
Aroclor-1248 (PCB-1248)	mg/kg	ND(38)	ND(3.7)	0.19	ND(3.6)	ND(18)	ND(180)	ND(0.18)	ND(36)	ND(3.6)	ND(3.6)	1.2
Aroclor-1254 (PCB-1254)	mg/kg	ND(38)	ND(3.7)	ND(0.036)	ND(3.6)	ND(18)	ND(180)	ND(0.18)	ND(36)	ND(3.6)	ND(3.6)	ND(0.36)
Aroclor-1260 (PCB-1260)	mg/kg	ND(38)	ND(3.7)	ND(0.036)	ND(3.6)	ND(18)	ND(180)	ND(0.18)	ND(36)	ND(3.6)	ND(3.6)	ND(0.36)

Sample Location		B-11	B-11	B-11	B-11	B-12	B-12	B-12	B-12	B-13	B-13	B-13
Sample Identification		S-120298-JH-054	S-120298-JH-055	S-120298-JH-056	S-120298-JH-057	S-120298-JH-049	S-120298-JH-050	S-120298-JH-051	S-120298-JH-052	S-120298-JH-040	S-120298-JH-041	S-120298-JH-042
Sample Date		12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998
Sample Depth (ft bgs)	*Units*	(2-4)	(4-6)	(6-8)	(8-9)	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)	(2-4)	(4-6)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.35)	ND(0.37)	ND(3.4)	ND(18)	ND(18)	ND(19)	ND(0.038)	ND(0.038)	ND(0.36)	ND(1.8)	ND(3.6)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.35)	ND(0.37)	ND(3.4)	ND(18)	ND(18)	ND(19)	ND(0.038)	ND(0.038)	ND(0.36)	ND(1.8)	ND(3.6)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.35)	ND(0.37)	ND(3.4)	ND(18)	ND(18)	ND(19)	ND(0.038)	ND(0.038)	ND(0.36)	ND(1.8)	ND(3.6)
Aroclor-1242 (PCB-1242)	mg/kg	ND(0.35)	2	13	110	ND(18)	ND(19)	ND(0.038)	ND(0.038)	ND(0.36)	5.3	17
Aroclor-1248 (PCB-1248)	mg/kg	0.87	ND(0.37)	ND(3.4)	ND(18)	96	75	ND(0.038)	ND(0.038)	1.6	ND(1.8)	ND(3.6)
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.35)	ND(0.37)	ND(3.4)	ND(18)	ND(18)	ND(19)	ND(0.038)	ND(0.038)	ND(0.36)	ND(1.8)	ND(3.6)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.35)	ND(0.37)	ND(3.4)	ND(18)	ND(18)	ND(19)	ND(0.038)	ND(0.038)	ND(0.36)	ND(1.8)	ND(3.6)

Sample Location		B-13	B-14	B-14	B-14	B-14	B-14	B-15	B-15	B-15	B-15	B-16
Sample Identification		S-120298-JH-043	S-120298-JH-044	S-120298-JH-045	S-120298-JH-046	S-120298-JH-047	S-120298-JH-048	S-022399-JH-078	S-022399-JH-079	S-022399-JH-080	S-022399-JH-081	S-022399-JH-070
Sample Date		12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	12/2/1998	2/23/1999	2/23/1999	2/23/1999	2/23/1999	2/23/1999
Sample Depth (ft bgs)	*Units*	(6-8)	(0-2)	(2-4)	(4-6)	(6-8)	(8-10)	(0-2)	(2-4)	(4-6)	(6-8)	(0-2)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(3.7)	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	ND(3.7)	ND(18)	ND(3.5)	ND(38)	ND(0.47)
Aroclor-1221 (PCB-1221)	mg/kg	ND(3.7)	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	ND(3.7)	ND(18)	ND(3.5)	ND(38)	ND(0.47)
Aroclor-1232 (PCB-1232)	mg/kg	ND(3.7)	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	ND(3.7)	ND(18)	ND(3.5)	ND(38)	ND(0.47)
Aroclor-1242 (PCB-1242)	mg/kg	19	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	17	58	13	180	1.6
Aroclor-1248 (PCB-1248)	mg/kg	ND(3.7)	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	ND(3.7)	ND(18)	ND(3.5)	ND(38)	ND(0.47)
Aroclor-1254 (PCB-1254)	mg/kg	ND(3.7)	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	ND(3.7)	ND(18)	ND(3.5)	ND(38)	ND(0.47)
Aroclor-1260 (PCB-1260)	mg/kg	ND(3.7)	ND(0.038)	ND(0.038)	ND(0.039)	ND(0.036)	ND(0.036)	ND(3.7)	ND(18)	ND(3.5)	ND(38)	ND(0.47)

TABLE 4.2

SUMMARY OF CRA SOIL ANALYTICAL RESULTS
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location		*B-16*	*B-16*	*B-16*	*B-17*	*B-17*	*B-17*	*B-17*	*B-18*	*B-18*	*B-18*	*B-18*
Sample Identification		*S-022399-JH-071*	*S-022399-JH-072*	*S-022399-JH-073*	*S-022399-JH-074*	*S-022399-JH-075*	*S-022399-JH-076*	*S-022399-JH-077*	*S-022399-JH-062*	*S-022399-JH-063*	*S-022399-JH-064*	*S-022399-JH-065*
Sample Date		*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*
Sample Depth (ft bgs)	*Units*	*(2-4)*	*(4-6)*	*(6-8)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-8)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-8)*
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.038)	ND(3.6)	ND(0.037)	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	ND(0.38)	ND(0.37)	ND(0.036)	ND(0.039)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.038)	ND(3.6)	ND(0.037)	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	ND(0.38)	ND(0.37)	ND(0.036)	ND(0.039)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.038)	ND(3.6)	ND(0.037)	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	ND(0.38)	ND(0.37)	ND(0.036)	ND(0.039)
Aroclor-1242 (PCB-1242)	mg/kg	0.08	17	0.37	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	0.55	0.62	ND(0.036)	ND(0.039)
Aroclor-1248 (PCB-1248)	mg/kg	ND(0.038)	ND(3.6)	ND(0.037)	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	ND(0.38)	ND(0.37)	ND(0.036)	ND(0.039)
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.038)	ND(3.6)	ND(0.037)	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	ND(0.38)	ND(0.37)	ND(0.036)	ND(0.039)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.038)	ND(3.6)	ND(0.037)	ND(0.038)	ND(0.033)	ND(0.039)	ND(0.039)	ND(0.38)	ND(0.37)	ND(0.036)	ND(0.039)

Sample Location		*B-19*	*B-19*	*B-19*	*B-19*	*B-20*	*B-20*	*B-20*	*B-20*	*B-21*	*B-21*	*B-21*
Sample Identification		*S-022399-JH-066*	*S-022399-JH-067*	*S-022399-JH-068*	*S-022399-JH-069*	*S-091399-JH-082*	*S-091399-JH-083*	*S-091399-JH-084*	*S-091399-JH-085*	*S-091399-JH-086*	*S-091399-JH-087*	*S-091399-JH-088*
Sample Date		*2/23/1999*	*2/23/1999*	*2/23/1999*	*2/23/1999*	*9/13/1999*	*9/13/1999*	*9/13/1999*	*9/13/1999*	*9/13/1999*	*9/13/1999*	*9/13/1999*
Sample Depth (ft bgs)	*Units*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-8)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-8)*	*(0-2)*	*(2-4)*	*(4-6)*
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.35)	ND(3.7)	ND(3.6)	ND(3.9)	ND(0.037)	ND(0.038)	ND(0.038)	ND(0.037)	ND(0.35)	ND(0.036)	ND(0.038)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.35)	ND(3.7)	ND(3.6)	ND(3.9)	ND(0.037)	ND(0.038)	ND(0.038)	ND(0.037)	ND(0.35)	ND(0.036)	ND(0.038)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.35)	ND(3.7)	ND(3.6)	ND(3.9)	ND(0.037)	ND(0.038)	ND(0.038)	ND(0.037)	ND(0.35)	ND(0.036)	ND(0.038)
Aroclor-1242 (PCB-1242)	mg/kg	3.2	40	38	36	ND(0.037)	ND(0.038)	ND(0.038)	0.24	ND(0.35)	ND(0.036)	ND(0.038)
Aroclor-1248 (PCB-1248)	mg/kg	ND(0.35)	ND(3.7)	ND(3.6)	ND(3.9)	0.068	0.11	0.16	ND(0.037)	1.3	0.32	0.55
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.35)	ND(3.7)	ND(3.6)	ND(3.9)	ND(0.037)	ND(0.038)	ND(0.038)	ND(0.037)	ND(0.35)	ND(0.036)	ND(0.038)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.35)	ND(3.7)	ND(3.6)	ND(3.9)	ND(0.037)	ND(0.038)	ND(0.038)	ND(0.037)	ND(0.35)	ND(0.036)	ND(0.038)

Sample Location		*B-21*	*B-26*	*B-26*	*B-26*	*B-26*	*B-53*	*B-53*	*B-53*	*B-53*	*B-54*	*B-54*
Sample Identification		*S-091399-JH-089*	*S-091499-JH-106*	*S-091499-JH-107*	*S-091499-JH-108*	*S-091499-JH-109*	*S-030205-JH-049*	*S-030205-JH-050*	*S-030205-JH-051*	*S-030205-JH-052*	*S-030205-JH-045*	*S-030205-JH-046*
Sample Date		*9/13/1999*	*9/14/1999*	*9/14/1999*	*9/14/1999*	*9/14/1999*	*3/2/2005*	*3/2/2005*	*3/2/2005*	*3/2/2005*	*3/2/2005*	*3/2/2005*
Sample Depth (ft bgs)	*Units*	*(6-8)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-8)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-7)*	*(0-2)*	*(2-4)*
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.18)	ND(0.034)	ND(0.037)	ND(0.034)	ND(0.034)	ND(0.04)	ND(0.068)	ND(0.035)	ND(0.038)	ND(0.04)	ND(1.8)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.18)	ND(0.034)	ND(0.037)	ND(0.034)	ND(0.034)	ND(0.04)	ND(0.068)	ND(0.035)	ND(0.038)	ND(0.04)	ND(1.8)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.18)	ND(0.034)	ND(0.037)	ND(0.034)	ND(0.034)	ND(0.04)	ND(0.068)	ND(0.035)	ND(0.038)	ND(0.04)	ND(1.8)
Aroclor-1242 (PCB-1242)	mg/kg	ND(0.18)	ND(0.034)	ND(0.037)	ND(0.034)	ND(0.034)	ND(0.04)	ND(0.068)	ND(0.035)	ND(0.038)	0.07	29
Aroclor-1248 (PCB-1248)	mg/kg	1.6	0.078	0.12	0.14	0.049	0.046	0.17	0.28	ND(0.038)	ND(0.04)	ND(1.8)
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.18)	ND(0.034)	ND(0.037)	ND(0.034)	ND(0.034)	ND(0.04)	ND(0.068)	ND(0.035)	ND(0.038)	ND(0.04)	ND(1.8)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.18)	ND(0.034)	ND(0.037)	ND(0.034)	ND(0.034)	ND(0.04)	ND(0.068)	0.056	ND(0.038)	ND(0.04)	ND(1.8)

TABLE 4.2

SUMMARY OF CRA SOIL ANALYTICAL RESULTS
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location		B-54	B-54	B-55	B-55	B-55	B-55	B-56	B-56	B-56	B-56	B-57
Sample Identification		S-030205-JH-047	S-030205-JH-048	S-030205-JH-041	S-030205-JH-042	S-030205-JH-043	S-030205-JH-044	S-030205-JH-037	S-030205-JH-038	S-030205-JH-039	S-030205-JH-040	S-030205-JH-033
Sample Date		3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005
Sample Depth (ft bgs)	*Units*	(4-6)	(6-7)	(0-2)	(2-4)	(4-6)	(6-7)	(0-2)	(2-4)	(4-6)	(6-7)	(0-2)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(1.8)	ND(7.4)	ND(1.8)	ND(7.4)	ND(18)	ND(7.3)	ND(0.71)	ND(19)	ND(36)	ND(74)	ND(7.5)
Aroclor-1221 (PCB-1221)	mg/kg	ND(1.8)	ND(7.4)	ND(1.8)	ND(7.4)	ND(18)	ND(7.3)	ND(0.71)	ND(19)	ND(36)	ND(74)	ND(7.5)
Aroclor-1232 (PCB-1232)	mg/kg	ND(1.8)	ND(7.4)	ND(1.8)	ND(7.4)	ND(18)	ND(7.3)	ND(0.71)	ND(19)	ND(36)	ND(74)	ND(7.5)
Aroclor-1242 (PCB-1242)	mg/kg	18	ND(7.4)	ND(1.8)	50	56	77	ND(0.71)	51	260	1200	ND(7.5)
Aroclor-1248 (PCB-1248)	mg/kg	ND(1.8)	43	4.9	ND(7.4)	ND(18)	ND(7.3)	3.7	ND(19)	ND(36)	ND(74)	46
Aroclor-1254 (PCB-1254)	mg/kg	ND(1.8)	ND(7.4)	ND(1.8)	ND(7.4)	ND(18)	ND(7.3)	ND(0.71)	ND(19)	ND(36)	ND(74)	ND(7.5)
Aroclor-1260 (PCB-1260)	mg/kg	ND(1.8)	ND(7.4)	ND(1.8)	ND(7.4)	ND(18)	ND(7.3)	ND(0.71)	ND(19)	ND(36)	ND(74)	ND(7.5)

Sample Location		B-57	B-57	B-57	B-58	B-58	B-59	B-59	B-59	B-60	B-60	B-60
Sample Identification		S-030205-JH-034	S-030205-JH-035	S-030205-JH-036	S-030105-JH-008	S-030105-JH-009	S-030105-JH-005	S-030105-JH-006	S-030105-JH-007	S-030105-JH-001	S-030105-JH-002	S-030105-JH-003
Sample Date		3/2/2005	3/2/2005	3/2/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005
Sample Depth (ft bgs)	*Units*	(2-4)	(4-6)	(6-7)	(0-2)	(2-4)	(0-2)	(2-4)	(4-6)	(0-2)	(2-4)	(4-6)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(1.8)	ND(3.8)	ND(1.9)	ND(0.074)	ND(1.9)	ND(3.6)	ND(1.8)	ND(0.039)	ND(1.9)	ND(1.9)	ND(18)
Aroclor-1221 (PCB-1221)	mg/kg	ND(1.8)	ND(3.8)	ND(1.9)	ND(0.074)	ND(1.9)	ND(3.6)	ND(1.8)	ND(0.039)	ND(1.9)	ND(1.9)	ND(18)
Aroclor-1232 (PCB-1232)	mg/kg	ND(1.8)	ND(3.8)	ND(1.9)	ND(0.074)	ND(1.9)	ND(3.6)	ND(1.8)	ND(0.039)	ND(1.9)	ND(1.9)	ND(18)
Aroclor-1242 (PCB-1242)	mg/kg	11	21	18	ND(0.074)	ND(1.9)	ND(3.6)	ND(1.8)	ND(0.039)	ND(1.9)	29	81
Aroclor-1248 (PCB-1248)	mg/kg	ND(1.8)	ND(3.8)	ND(1.9)	0.28	8.7	17	8.6	ND(0.039)	16	ND(1.9)	ND(18)
Aroclor-1254 (PCB-1254)	mg/kg	ND(1.8)	ND(3.8)	ND(1.9)	ND(0.074)	ND(1.9)	ND(3.6)	ND(1.8)	ND(0.039)	ND(1.9)	ND(1.9)	ND(18)
Aroclor-1260 (PCB-1260)	mg/kg	ND(1.8)	ND(3.8)	ND(1.9)	ND(0.074)	ND(1.9)	ND(3.6)	ND(1.8)	ND(0.039)	ND(1.9)	ND(1.9)	ND(18)

Sample Location		B-60	B-61	B-61	B-61	B-61	B-62	B-62	B-62	B-62	B-62	B-63
Sample Identification		S-030105-JH-004	S-030105-JH-010	S-030105-JH-011	S-030105-JH-012	S-030105-JH-013	S-030105-JH-014	S-030105-JH-015	S-030105-JH-016	S-030105-JH-017	S-030105-JH-018	S-030105-JH-024
Sample Date		3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005	3/1/2005
Sample Depth (ft bgs)	*Units*	(6-7)	(0-2)	(2-4)	(4-6)	(6-7)	(0-2)	(2-4)	(4-6)	(6-8)	(8-10)	(0-2)
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(1.9)	ND(1.8)	ND(7.5)	ND(7.4)	ND(3.7)	ND(3.6)	ND(1.8)	ND(0.035)	ND(0.034)	ND(0.034)	ND(19)
Aroclor-1221 (PCB-1221)	mg/kg	ND(1.9)	ND(1.8)	ND(7.5)	ND(7.4)	ND(3.7)	ND(3.6)	ND(1.8)	ND(0.035)	ND(0.034)	ND(0.034)	ND(19)
Aroclor-1232 (PCB-1232)	mg/kg	ND(1.9)	ND(1.8)	ND(7.5)	ND(7.4)	ND(3.7)	ND(3.6)	ND(1.8)	0.14	ND(0.034)	ND(0.034)	ND(19)
Aroclor-1242 (PCB-1242)	mg/kg	15	ND(1.8)	28	22	13	ND(3.6)	ND(1.8)	ND(0.035)	ND(0.034)	0.037	ND(19)
Aroclor-1248 (PCB-1248)	mg/kg	ND(1.9)	5.7	ND(7.5)	ND(7.4)	ND(3.7)	12	11	ND(0.035)	ND(0.034)	ND(0.034)	85
Aroclor-1254 (PCB-1254)	mg/kg	ND(1.9)	ND(1.8)	ND(7.5)	ND(7.4)	ND(3.7)	ND(3.6)	ND(1.8)	ND(0.035)	ND(0.034)	ND(0.034)	ND(19)
Aroclor-1260 (PCB-1260)	mg/kg	ND(1.9)	ND(1.8)	ND(7.5)	ND(7.4)	ND(3.7)	ND(3.6)	ND(1.8)	ND(0.035)	ND(0.034)	ND(0.034)	ND(19)

TABLE 4.2

SUMMARY OF CRA SOIL ANALYTICAL RESULTS
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Sample Location		*B-63*	*B-63*	*B-64*	*B-64*	*B-64*	*B-64*	*B-64*	*B-65*	*B-65*	*B-65*	*B-65*
Sample Identification		*S-030105-JH-025*	*S-030105-JH-026*	*S-030105-JH-019*	*S-030105-JH-020*	*S-030105-JH-021*	*S-030105-JH-022*	*S-030105-JH-023*	*S-030105-JH-027*	*S-030105-JH-028*	*S-030105-JH-029*	*S-030105-JH-030*
Sample Date		*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*	*3/1/2005*
Sample Depth (ft bgs)	*Units*	*(2-4)*	*(4-6)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-8)*	*(8-10)*	*(0-2)*	*(2-4)*	*(4-6)*	*(6-7)*
PCBs												
Aroclor-1016 (PCB-1016)	mg/kg	ND(0.047)	ND(0.036)	ND(0.72)	ND(0.035)	ND(0.035)	ND(3.7)	ND(0.038)	ND(0.75)	ND(0.19)	ND(0.035)	ND(0.069)
Aroclor-1221 (PCB-1221)	mg/kg	ND(0.047)	ND(0.036)	ND(0.72)	ND(0.035)	ND(0.035)	ND(3.7)	ND(0.038)	ND(0.75)	ND(0.19)	ND(0.035)	ND(0.069)
Aroclor-1232 (PCB-1232)	mg/kg	ND(0.047)	ND(0.036)	ND(0.72)	ND(0.035)	ND(0.035)	ND(3.7)	ND(0.038)	ND(0.75)	ND(0.19)	ND(0.035)	ND(0.069)
Aroclor-1242 (PCB-1242)	mg/kg	ND(0.047)	ND(0.036)	ND(0.72)	ND(0.035)	ND(0.035)	41	0.062	ND(0.75)	ND(0.19)	ND(0.035)	ND(0.069)
Aroclor-1248 (PCB-1248)	mg/kg	0.075	ND(0.036)	2.5	ND(0.035)	ND(0.035)	ND(3.7)	ND(0.038)	3.3	0.6	0.12	0.28
Aroclor-1254 (PCB-1254)	mg/kg	ND(0.047)	ND(0.036)	ND(0.72)	ND(0.035)	ND(0.035)	ND(3.7)	ND(0.038)	ND(0.75)	ND(0.19)	ND(0.035)	ND(0.069)
Aroclor-1260 (PCB-1260)	mg/kg	ND(0.047)	ND(0.036)	ND(0.72)	ND(0.035)	ND(0.035)	ND(3.7)	ND(0.038)	ND(0.75)	ND(0.19)	ND(0.035)	ND(0.069)

Sample Location		*B-66*	*B-66*
Sample Identification		*S-030105-JH-031*	*S-030105-JH-032*
Sample Date		*3/1/2005*	*3/1/2005*
Sample Depth (ft bgs)	*Units*	*(0-2)*	*(2-4)*
PCBs			
Aroclor-1016 (PCB-1016)	mg/kg	ND(19)	ND(7.6)
Aroclor-1221 (PCB-1221)	mg/kg	ND(19)	ND(7.6)
Aroclor-1232 (PCB-1232)	mg/kg	ND(19)	ND(7.6)
Aroclor-1242 (PCB-1242)	mg/kg	ND(19)	ND(7.6)
Aroclor-1248 (PCB-1248)	mg/kg	77	46
Aroclor-1254 (PCB-1254)	mg/kg	ND(19)	ND(7.6)
Aroclor-1260 (PCB-1260)	mg/kg	ND(19)	ND(7.6)

Notes:
ft bgs - feet below ground surface
mg/kg - milligrams per kilogram
ND ( ) - not detected at the detection limit shown in parentheses.

TABLE 8.1

POTENTIAL CHEMICAL-SPECIFIC ARARs
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Potential Chemical-Specific Requirements	*Citation*
Disposal of Polychlorinated Biphenyls	40 Code of Federal Regulations (CFR) 761
Risk-Based Cleanup Objectives	35 Illinois Administrative Code (IAC) 742
Illinois Water Quality Standards	35 IAC 302
Illinois Groundwater Quality Standards	35 IAC 620
Federal Drinking Water Standards	40 CFR 141

TABLE 8.2

POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC ARARS
SWALE AREA
CATERPILLAR, INC.
MAPLETON, ILLINOIS

Location	*Requirement*	*Citation*	*Applicable, Appropriate or Relevant*
Critical habitat upon which endangered species or threatened species depends	Action to conserve endangered species or threatened species, including consultation with the Department of Interior	Endangered Species Act of 1973 (16 USC 1531 et. Seq.); 50 CFR Part 200; 50 CFR Part 402 Fish and Wildlife Coordination Act (16 USC 661 et. seq.); 33 CFR Parts 320-330.	NA
Near a coastal zone	Protect land and waters of coastal zones.	Coastal Zone Management Act, 16 USC 1451	NA
Near a designated coastal barrier	Minimize the damage to fish, wildlife and other natural resources associated with the coastal barriers.	Coastal Barrier Resources Act, 16 USC 3501	NA
Near a Federally-owned area designated as a wilderness area	Protect and preserve Federally designated areas as "wilderness areas".	Wilderness Act, 16 USC 1131	NA
Near a National Wildlife Refuge System	Conservation of fish and wildlife including species that are threatened.	Wildlife Refuge, 16 USC 668 dd; 50 CFR 27	NA

Notes:
Modified from Exhibit 1-2 of USEPA's Draft Guidance CERCLA Compliance With Other Laws (August 1988).
N/A - Not Applicable

TABLE 8.2

**POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC ARARS
SWALE AREA
CATERPILLAR, INC.
MAPLETON, ILLINOIS**

Location	*Requirement*	*Citation*	*Applicable, Appropriate or Relevant*
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to prevent washout.	40 CFR 264.18(b);	NA
Within floodplain	Action must avoid adverse effects, minimize potential harm, and if necessary, restore and preserve natural and beneficial values of the floodplain.	Executive Order 11988, Floodplain Management, (40 CFR 6, Appendix A)	NA
Within floodplain in Illinois	Action must avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.	Illinois Flood Control Act	NA
	Construction of abodes or residences is prohibited and prior approval is required for other types of construction, excavation, or filling in or on a floodway. This includes but is not limited to construction of a fence, water treatment facility, dredging, and/or dewatering in a floodway.		
Wetland	Action must minimize the destruction, loss, or degradation of wetlands and to preserve the value of wetlands.	Executive Order 11990, Protection of Wetlands, (40 CFR 6, Appendix A)	NA
	Discharge of dredged or fill material into wetlands without permit is prohibited. Water quality certification may also be required from IDEM.	Clean Water Act, Sections 401 and 404; 40 CFR Parts 230, 231	

TABLE 8.3

POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC ARARs
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Actions	*Requirement*	*Citation*
Construction Activity	Stormwater runoff associated with construction activity.	40 CFR 122.26; 35 IAC 309 Illinois General NPDES Permit No. ILR10
	Fugitive dust emissions during construction activity	35 IAC 212
Operation and maintenance (O&M)	Post-closure care to ensure that site is maintained and monitored.	40 CFR 264.118 (RCRA Subpart G)
	Develop Contingency Plan and Emergency Procedures to minimize potential hazards from fires, explosions or any unplanned release during closure and post-closure status.	40 CFR 264 (Subpart D)
Surface water control and discharge	Prevent run-on, and control and collect runoff from a 24-hour, 25-year storm during closure and post-closure status.	40 CFR 264.301(f)(g)(h)(i);
	Management of stormwater run-off associated with Construction Activity, and stormwater run-off associated with industrial activity.	40 CFR 122.26; 35 IAC 309; Illinois General NPDES Permit No. ILR10 (Construction) Illinois General NPDES Permit No. ILR00 (Industrial)
Excavation	Develop fugitive and odor emission control plan for this action if existing site plan is inadequate.	CAA Section 101[2]; 40 CFR 52[2]
	Particulate emissions from earth moving and material handling activities must be controlled, such that no visible emissions cross the property line and the increase in upward/downward total suspended particulate concentration is limited to 50 $\mu g/m^3$.	35 IAC 212
	Register with Commissioner of the State to include estimation of emission rates for each pollutant expected.	40 CFR 52[2]; 35 IAC 201

Notes:

1 Modified from Exhibit 1-3 of USEPA's Draft Guidance CERCLA Compliance With Other Laws (August 1988) and Exhibit 1-3 of CERCLA Compliance With Other Laws, Part II (August 1989).

2 All of the Clean Air Act ARARs that have been established by the Federal government may be covered by matching State regulations. The State may have the authority to manage these programs through the approval of its implementation plans (40 CFR 52).

Key:

CAA = Clean Air Act
CFR = Code of Federal Regulations
CWA = Clean Water Act
IAC = Illinois Administrative Code

TABLE 9.1

REMEDIAL TECHNOLOGIES SCREENING SUMMARY
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Technology	*Description*	*Effectiveness*	*Implementability*	*Short Term Risk*	*Relative Cost*	*Retain*
No Action						
No Action	No remedial technologies are implemented at the Site	May not achieve remedial action objectives	No Action alternative is required	None	Low	Yes
Administrative Controls and Monitoring						
Monitoring	Inspection of remedial measures (fencing, caps, etc.)	Effective at determining Site conditions	Easily implementable	Low	Low	Yes
Deed Restrictions	Restrictive covenants on deed	Effective at minimizing potential exposure to soil	Easily implementable	None	Low	Yes
Access Controls	Construct/maintain perimeter fencing	Effective at minimizing potential exposure to soil	Easily Implementable	Low	Low	Yes
Restrictive Ordinances	State or Local zoning restrictions on property use	Ineffective at Site	Not implementable. No zoning ordinances	None	Low	No

TABLE 9.1

REMEDIAL TECHNOLOGIES SCREENING SUMMARY
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Technology	*Description*	*Effectiveness*	*Implementability*	*Short Term Risk*	*Relative Cost*	*Retain*
Encapsulation						
Vegetative Cover	Place a layer of topsoil and seed	Effective at stabilizing surface soil. May not meet ARARs	Implementable	Low	Low	Yes
Capping	Construction of a barrier of clay, concrete, and asphalt meeting requirements of 761.61	Effective at minimizing exposure to soil, limiting percolation, and preventing erosion	Implementable	Low to Moderate	Moderate	Yes
Removal						
Excavation and Off-Site Landfilling	Excavate, transport, and dispose of soil at an off-Site landfill	Effective at minimizing exposure to soil. Permanently removes PCBs from Site	Implementable	Moderate	High	No
Soil Treatment						
Incineration	Excavate, transport, and treat soil at TSCA incineration facility	Permanent solution	Implementable	Moderate to High	Prohibitively High	No
Solvent Extraction/Washing	Chemically remove PCBs from soil	Permanent solution. Questionable effectiveness	Difficult to Implement	Moderate to High	Prohibitively High	No

TABLE 10.1

COST PROJECTION
ALTERNATIVE 2 - PARTIAL CAPPING/ VEGETATIVE COVER
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Description	*Units*	*Quantity*	*Unit Price*	*Total*
Capital Construction Costs				
Predesign Investigation	LS	1	$21,000.00	$21,000
Site Preparation				
Well Abandonment/Modifications	Each	6	$750.00	$4,500
Clearing and Grubbing	Acre	13	$500.00	$6,500
Rough Grading and Shaping	CY	11,500	$6.25	$71,875
AST Tank Farm Demolition				
AST Cleaning & Removal & Demolition of Structures	LS	1	$27,000.00	$27,000
T & D of Demolition Debris (120 CY Concrete)	CY	120	$36.00	$4,320
Diesel Tank Farm Demolition				
AST Cleaning & Removal	EA	1	$21,200.00	$21,200
T & D of Demolition Debris (120 CY concrete)	CY	120	$36.00	$4,320
Building P Demolition				
Remove Fan and Ductwork East of Building P	LS	1	$3,100.00	$3,100
Remove Fan Stack West of Building P Annex	LS	1	$2,900.00	$2,900
Remove Building P Annex	LS	1	$8,100.00	$8,100
Building V Pavement				
Concrete with reinforcement (6 in.)	SY	450	$36.00	$16,200
Base course placement (6 in. rock)	SY	450	$4.70	$2,115
Subgrade preparation	CY	140	$12.50	$1,750
Vegetative Cover Construction (9.3 acres)				
Topsoil (4")	CY	5,000	$30.00	$150,000
Seeding/Fertilizing/Mulching	Acre	9	$3,300.00	$30,690
Install Additional Groundwater Monitoring Wells	EA	7	$1,000.00	$7,000
Compacted Soil Cap (3.7 acres)				
Rework and compact subgrade (top 6 ")	CY	3,000	$1.05	$3,150
Compacted soil layer (6" use onsite soil)	CY	3,000	$15.00	$45,000
Topsoil (4")	CY	2,000	$30.00	$60,000
Seeding/Fertilizing/Mulching	Acre	4	$3,300.00	$12,210
Asphalt Roads and Driveways - Building R Complex				
Asphalt placement (4 in. binder + 3 in. surface)	SY	2,100	$17.50	$36,750
Base course placement with fabric (6 in. rock)	SY	2,100	$8.50	$17,850
Subgrade preparation	SY	2,100	$1.60	$3,360
Asphalt Access Road - Landfill Access Road				
Asphalt placement (4 in. binder + 3 in. surface)	SY	1,000	$17.50	$17,500
Base course placement with fabric (12 in. rock)	SY	1,000	$14.50	$14,500
Subgrade preparation	SY	1,000	$1.60	$1,600

TABLE 10.1

COST PROJECTION
ALTERNATIVE 2 - PARTIAL CAPPING/ VEGETATIVE COVER
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Description	*Units*	*Quantity*	*Unit Price*	*Total*
Grassed Drainage Channel (Land West of Building B)				
Grade and Shape	LF	1600	$0.50	$800
Seeding/Fertilizing/Mulching	Acre	1.4	$3,300.00	$4,620
Gabions at Outfall	SY	125	$52.00	$6,500
Security				
Fencing and Signage (6' chain link) (Swale Area and Land West of Building B)	LF	8,000	$25.50	$204,000
			Subtotal	**$810,000**
Project Administration				
Bonds and Insurance	%	2	$16,200.00	$16,200
Mobilization/Demobilization	%	5	$40,500.00	$40,500
Permits	%	2	$16,200.00	$16,200
Health and Safety	%	3	$24,300.00	$24,300
Construction Facilities and Temporary Controls	%	1	$8,100.00	$8,100
			Subtotal	**$915,300**
			Engineering (20%)	**$183,060**
			TOTAL CAPITAL CONSTRUCTION COST	**$1,100,000**
Annual Operations and Maintenance Costs				
Inspections and Reporting (Years 1 through 5)	EA	20	$5,000	$100,000
Inspection and Reporting (Years 6 through 10)	EA	10	$5,000	$50,000
Inspection and Reporting (Years 11 through 30)	EA	20	$5,000	$100,000
Cap Maintenance	YR	30	$2,500	$75,000
			TOTAL ANNUAL O & M COST	**$325,000**
			PRESENT WORTH OM&M COSTS (5% DISCOUNT RATE)	**$170,000**
			TOTAL CAPITAL AND OM&M COSTS	**$1,270,000**

Notes:
LS - lump sum
CY - cubic yard
SY - square yard
LF - linear feet
EA - each
YR - year

TABLE 10.2

COST PROJECTION
ALTERNATIVE 3 - CAPPING
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Description	*Units*	*Quantity*	*Unit Price*	*Total*
Capital Construction Costs				
Predesign Investigation	LS	1	$21,000.00	$21,000
Site Preparation				
Well Abandonment/Modifications	Each	6	$750.00	$4,500
Clearing and Grubbing	Acre	13	$500.00	$6,500
Rough Grading and Shaping	CY	11,500	$6.25	$71,875
AST Tank Farm Demolition				
AST Cleaning & Removal & Demolition of Structures	LS	1	$27,000.00	$27,000
T & D of Demolition Debris (120 CY Concrete)	CY	120	$36.00	$4,320
Diesel Tank Farm Demolition				
AST Cleaning & Removal	EA	1	$21,200.00	$21,200
T & D of Demolition Debris (120 CY concrete)	CY	120	$36.00	$4,320
Building P Demolition				
Remove Fan and Ductwork East of Building P	LS	1	$3,100.00	$3,100
Remove Fan Stack West of Building P Annex	LS	1	$2,900.00	$2,900
Remove Building P Annex	LS	1	$8,100.00	$8,100
Building V Pavement				
Concrete with reinforcement (6 in.)	SY	450	$36.00	$16,200
Base course placement (6 in. rock)	SY	450	$4.70	$2,115
Subgrade preparation	CY	140	$12.50	$1,750
Compacted Soil Cap Construction (13 acres)				
Rework and compact subgrade (top 6 ")	CY	10,500	$1.05	$11,025
Compacted soil layer (6")	CY	10,500	$15.00	$157,500
Topsoil (4")	CY	7,000	$30.00	$210,000
Seeding/Fertilizing/Mulching	Acre	13	$3,300.00	$42,900
Install Additional Groundwater Monitoring Wells	EA	7	$1,000.00	$7,000
Asphalt Roads and Driveways - Building R Complex				
Asphalt placement (4 in. binder + 3 in. surface)	SY	2,100	$17.50	$36,750
Base course placement with fabric (6 in. rock)	SY	2,100	$8.50	$17,850
Subgrade preparation	SY	2,100	$1.60	$3,360
Asphalt Access Road - Landfill Access Road				
Asphalt placement (4 in. binder + 3 in. surface)	SY	1,000	$17.50	$17,500
Base course placement with fabric (12 in. rock)	SY	1,000	$14.50	$14,500
Subgrade preparation	SY	1,000	$1.60	$1,600

TABLE 10.2

COST PROJECTION
ALTERNATIVE 3 - CAPPING
SWALE AREA
CATERPILLAR INC.
MAPLETON, ILLINOIS

Description	*Units*	*Quantity*	*Unit Price*	*Total*
Grassed Drainage Channel (Land West of Building B)				
Grade and Shape	LF	1600	$0.50	$800
Seeding/Fertilizer/Mulching	Acre	1.4	$3,300.00	$4,620
Gabions at Outfall	SY	125	$52.00	$6,500
Security				
Fencing and Signage (6' chain link)	LF	8,000	$25.50	$204,000
			Subtotal	**$930,000**
Project Administration				
Bonds and Insurance	%	2	$18,600.00	$18,600
Mobilization/Demobilization	%	5	$46,500.00	$46,500
Permits	%	2	$18,600.00	$18,600
Health and Safety	%	3	$27,900.00	$27,900
Construction Facilities and Temporary Controls	%	1	$9,300.00	$9,300
			Subtotal	**$1,050,900**
			Engineering (20%)	**$210,180**
			TOTAL CAPITAL CONSTRUCTION COST	**$1,260,000**
Annual Operations and Maintenance Costs				
Inspections and Reporting (Years 1 through 5)	EA	20	$5,000	$100,000
Inspection and Reporting (Years 6 through 10)	EA	10	$5,000	$50,000
Inspection and Reporting (Years 11 through 30)	EA	20	$5,000	$100,000
Cap Maintenance	YR	30	$2,500	$75,000
			TOTAL ANNUAL O & M COST	**$325,000**
			PRESENT WORTH OM&M COSTS (5% DISCOUNT RATE)	**$170,000**
			TOTAL CAPITAL AND OM&M COSTS	**$1,430,000**

Notes:
LS - lump sum
CY - cubic yard
SY - square yard
LF - linear feet
EA - each
YR - year

Caterpillar - December 1998 Sample Results (ppm)

Samples taken in Swale Area

Sample Number	Comment	0-2 ft	2-4 ft	3-5 ft	4-5 ft	4-6 ft	5-7 ft	6-8 ft	7-9 ft	8-9 ft	8-10 ft	9-11 ft	10-12 ft
B-1	Inside former drum storage area	1	n/d			64		39					
B-2	Around former drum storage area	n/d	n/d			570		1.2					
B-3	Around former drum storage area	2.4		1.8			0.48		n/d			n/d	
B-4	Around former drum storage area	3.4	n/d			n/d		1.2			n/d		
B-5	Around former drum storage area	0.22	3.3			1.4		21					
B-6	Around former drum storage area	6.7	1.5			1.8		57					
B-7	Around former drum storage area	14	260			17		92					
B-8	Around former drum storage area	6.1	6.8		120		130		35				
B-9		0.19	29			73		700					
B-10		0.43	58			7.7		10					
B-11		1.2	0.87			2		13		110			
B-12	text says 23 ppm at 0-2 ft	96	75			n/d		n/d					
B-13		1.6	5.3			17		19					
B-14		n/d	n/d			n/d		n/d			n/d		

Caterpillar - December 1 and 2, 1998 Sample Results (ppm)
Samples Taken in Swale Area

Sample Number	Results	
S-120198-JH-001	2.4	B-3
S-120198-JH-002	1.8	B-3
S-120198-JH-003	0.48	B-3
S-120198-JH-004	nd	B-3
S-120198-JH-005	nd	B-3
S-120198-JH-006	3.4	B-4
S-120198-JH-007	nd	B-4
S-120198-JH-008	nd	B-4
S-120198-JH-009	1.2	B-4
S-120198-JH-010	nd	B-4
S-120198-JH-011	0.22	B-5
S-120198-JH-012	3.3	B-5
S-120198-JH-013	1.4	B-5
S-120198-JH-014	21	B-5
S-120198-JH-015	nd	B-2
S-120198-JH-016	nd	B-2
S-120198-JH-017	570	B-2
S-120198-JH-018	1.2	B-2
S-120198-JH-019	6.7	B-6
S-120198-JH-020	1.5	B-6
S-120198-JH-021	1.8	B-6
S-120198-JH-022	57	B-6
S-120198-JH-023	14	B-7
S-120198-JH-024	260	B-7
S-120198-JH-025	17	B-7
S-120198-JH-026	92	B-7
S-120198-JH-027	6.1	B-8
S-120198-JH-028	6.8	B-8
S-120198-JH-029	120	B-8
S-120198-JH-030	130	B-8
S-120198-JH-031	35	B-8

Sample Number	Results	
S-120198-JH-032	1	B-1
S-120198-JH-033	nd	B-1
S-120198-JH-034	64	B-1
S-120198-JH-035	39	B-1
S-120298-JH-036	0.43	B-10
S-120298-JH-037	58	B-10
S-120298-JH-038	7.7	B-10
S-120298-JH-039	10	B-10
S-120298-JH-040	1.6	B-13
S-120298-JH-041	5.3	B-13
S-120298-JH-042	17	B-13
S-120298-JH-043	19	B-13
S-120298-JH-044	nd	B-14
S-120298-JH-045	nd	B-14
S-120298-JH-046	nd	B-14
S-120298-JH-047	nd	B-14
S-120298-JH-048	nd	B-14
S-120298-JH-049	96	B-12
S-120298-JH-050	75	B-12
S-120298-JH-051	nd	B-12
S-120298-JH-052	nd	B-12
S-120298-JH-053	1.2	B-11
S-120298-JH-054	0.87	B-11
S-120298-JH-055	2	B-11
S-120298-JH-056	13	B-11
S-120298-JH-057	110	B-11
S-120298-JH-058	0.19	B-9
S-120298-JH-059	29	B-9
S-120298-JH-060	73	B-9
S-120298-JH-061	700	B-9

Caterpillar - February 1999 Sample Results (ppm)

Samples Taken in Swale Area

Sample Number	Comment	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-15		17	58	13	180		
B-16		1.6	0.08	17	0.37		
B-17		n/d	n/d	n/d	n/d		
B-18	All Under 1 ppm	0.55	0.62	n/d	n/d		
B-19		3.2	40	38	36		

Caterpillar - February 23, 1999 Sample Results (ppm)

Samples taken in Swale Area

Sample Number	Results	
S-022399-JH-062	0.55	B-18
S-022399-JH-063	0.62	B-18
S-022399-JH-064	nd	B-18
S-022399-JH-065	nd	B-18
S-022399-JH-066	3.2	B-19
S-022399-JH-067	40	B-19
S-022399-JH-068	38	B-19
S-022399-JH-069	36	B-19
S-022399-JH-070	1.6	B-16
S-022399-JH-071	0.08	B-16
S-022399-JH-072	17	B-16
S-022399-JH-073	0.37	B-16
S-022399-JH-074	nd	B-17
S-022399-JH-075	nd	B-17
S-022399-JH-076	nd	B-17
S-022399-JH-077	nd	B-17
S-022399-JH-078	17	B-15
S-022399-JH-079	58	B-15
S-022399-JH-080	13	B-15
S-022399-JH-081	180	B-15

Caterpillar - September 1999 Sample Results (ppm)

Samples taken within Swale Area

Sample Number	Comment	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-20	All Under 1 ppm	0.068	0.11	0.16	0.24		
B-21		1.3	0.32	0.55	1.6		
B-26	All Under 1 ppm						

Caterpillar - September 1999 Sample Results (ppm)

Samples taken between Building B and Little LaMarsh Creek

Sample Number	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-22	n/d	n/d	n/d	n/d		
B-23	n/d	n/d	n/d	n/d		
B-24	n/d	n/d	n/d	n/d		
B-25	n/d	0.36	0.84	0.64		
B-27	n/d	n/d	0.36	0.2		
B-28	0.2	0.17	n/d	0.043	0.046	
B-29	n/d	n/d	0.43	0.58		
B-30	n/d	n/d	0.91	0.14		
B-31	n/d	0.48	0.65	0.043		
B-32	0.22	1.7	0.037	8.2		
B-33	n/d	0.36	0.59			
B-34	0.9	2.2	2.3			

Caterpillar - September 13 and 14, 1999 Sample Results (ppm)

Bldg B -- B-22 through B-25 and B-27 through B-34
Swale -- B20, B21, B26

Sample Number	Results		Sample Number	Results	
S-091399-JH-082	0.068	B-20	S-091499-JH-112	0.36	B-27
S-091399-JH-083	0.11	B-20	S-091499-JH-113	0.245	B-27
S-091399-JH-084	0.16	B-20	S-091499-JH-114	0.2	B-28
S-091399-JH-085	0.24	B-20	S-091499-JH-115	0.17	B-28
S-091399-JH-086	1.3	B-21	S-091499-JH-116	nd	B-28
S-091399-JH-087	0.32	B-21	S-091499-JH-117	0.043	B-28
S-091399-JH-088	0.55	B-21	S-091499-JH-118	0.046	B-28
S-091399-JH-089	1.6	B-21	S-091499-JH-119	nd	B-29
S-091499-JH-090	nd	B-22	S-091499-JH-120	nd	B-29
S-091499-JH-091	nd	B-22	S-091499-JH-121	0.43	B-29
S-091499-JH-092	nd	B-22	S-091499-JH-122	0.58	B-29
S-091499-JH-093	nd	B-22	S-091499-JH-123	nd	B-30
S-091499-JH-094	nd	B-23	S-091499-JH-124	nd	B-30
S-091499-JH-095	nd	B-23	S-091499-JH-125	0.91	B-30
S-091499-JH-096	nd	B-23	S-091499-JH-126	0.14	B-30
S-091499-JH-097	nd	B-23	S-091499-JH-127	nd	B-31
S-091499-JH-098	nd	B-24	S-091499-JH-128	0.48	B-31
S-091499-JH-099	nd	B-24	S-091499-JH-129	0.065	B-31
S-091499-JH-100	nd	B-24	S-091499-JH-130	0.043	B-31
S-091499-JH-101	nd	B-24	S-091499-JH-131	nd	B-33
S-091499-JH-102	nd	B-25	S-091499-JH-132	0.36	B-33
S-091499-JH-103	0.36	B-25	S-091499-JH-133	0.59	B-33
S-091499-JH-104	0.84	B-25	S-091499-JH-134	0.9	B-34
S-091499-JH-105	0.64	B-25	S-091499-JH-135	2.2	B-34
S-091499-JH-106	0.78	B-26	S-091499-JH-136	2.3	B-34
S-091499-JH-107	0.12	B-26	S-091499-JH-137	0.22	B-32
S-091499-JH-108	0.14	B-26	S-091499-JH-138	1.7	B-32
S-091499-JH-109	0.049	B-26	S-091499-JH-139	0.037	B-32
S-091499-JH-110	nd	B-27	S-091499-JH-140	8.2	B-32
S-091499-JH-111	nd	B-27			

Caterpillar - December 1999 and January 2000
Groundwater Sample Results (ppm)

Samples Taken from Groundwater Wells within Swale Area

Well Number	Sample Date	Comment	Results
MW 99A	Dec-99		n/d
MW 99B	Jan-00	Slow Recovery	n/d
MW 99C	Dec-99		n/d

Caterpillar - March 1 and 2, 2005 PCB Sample Results (ppm)

Bldg B and LLMC -- B37 through B-39 and B-42 through B-45

Sample Number	Results	Sample Number	Results	Sample Number	Results	
S-030105-JH-001	16	S-030105-JH-026	nd	S-030205-JH-051	0.28/.056	
S-030105-JH-002	29	S-030105-JH-027	3.3	S-030205-JH-052	nd	
S-030105-JH-003	81	S-030105-JH-028	0.6	S-030205-JH-053	0.055	B-44
S-030105-JH-004	15	S-030105-JH-029	0.12	S-030205-JH-054	nd	B-44
S-030105-JH-005	17	S-030105-JH-030	0.28	S-030205-JH-055	nd	B-45
S-030105-JH-006	8.6	S-030105-JH-031	77	S-030205-JH-056	nd	B-38
S-030105-JH-007	nd	S-030105-JH-032	46	S-030205-JH-057	3.1	B-38
S-030105-JH-008	0.28	S-030205-JH-033	46	S-030205-JH-058	3.3	B-38
S-030105-JH-009	8.7	S-030205-JH-034	11	S-030205-JH-059	5	B-38
S-030105-JH-010	5.7	S-030205-JH-035	21	S-030205-JH-060	0.32	B-37
S-030105-JH-011	28	S-030205-JH-036	18	S-030205-JH-061	5.3	B-37
S-030105-JH-012	22	S-030205-JH-037	3.7	S-030205-JH-062	23	B-37
S-030105-JH-013	13	S-030205-JH-038	51	S-030205-JH-063	3	B-37
S-030105-JH-014	12	S-030205-JH-039	260	S-030205-JH-064	0.48	B-39
S-030105-JH-015	11	**S-030205-JH-040**	**1200**	S-030205-JH-065	2	B-39
S-030105-JH-016	0.14	S-030205-JH-041	4.9	S-030205-JH-066	4.5	B-39
S-030105-JH-017	nd	S-030205-JH-042	50	S-030205-JH-067	4.4	B-39
S-030105-JH-018	0.037	S-030205-JH-043	56	S-030205-JH-068	1.6	B-43
S-030105-JH-019	2.5	S-030205-JH-044	77	S-030205-JH-069	1.1	B-43
S-030105-JH-020	nd	S-030205-JH-045	0.07	S-030205-JH-070	1.9	B-43
S-030105-JH-021	nd	S-030205-JH-046	29	S-030205-JH-071	0.38	B-43
S-030105-JH-022	41	S-030205-JH-047	18	S-030205-JH-072	2.1	B-42
S-030105-JH-023	0.062	S-030205-JH-048	43	S-030205-JH-073	2.1	B-42
S-030105-JH-024	85	S-030205-JH-049	0.046	S-030205-JH-074	7.1	B-42
S-030105-JH-025	0.075	S-030205-JH-050	0.17	S-030205-JH-075	0.25	B-42

S-030105-JH-040 **1200**

Is it same as B-56 at 6-7 '?

Caterpillar - March 2, 2005 Sample Results (ppm)

Samples taken between Building B and Little LaMarsh Creek

Sample Number	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-37	0.32	5.3	23	3		
B-38	n/d	3.1	3.3	5		
B-39	0.48	2	4.5	4.4		
B-42	2.1	2.1	7.1	0.25		
B-43	1.6	1.1	1.9	0.38		
B-44	0.055	n/d				
B-45	n/d					

Caterpillar - April 2005 Sample Results (ppm)

Samples taken between Building B and Little LaMarsh Creek

Sample Number	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-35	n/d	1.3	0.54	0.46		
B-36	n/d	1.1	1.9	0.58		
B-40	n/d	3.3	0.46	n/d		
B-41	n/d	1.2	0.43	n/d		
B-46	n/d					
B-47	n/d					
B-48	n/d					
B-49	n/d					
B-50	n/d					
B-51	0.69	0.84	19	4.6		0.54
B-52	n/d	n/d				

Caterpillar - April 7, 2005 Sample Results (ppm)

Samples taken between Building B and LLMC

Sample Number	Results	
S-040705-JH-076	nd	B-40
S-040705-JH-077	3.3	B-40
S-040705-JH-078	0.46	B-40
S-040705-JH-079	nd	B-40
S-040705-JH-080	nd	B-41
S-040705-JH-081	1.2	B-41
S-040705-JH-082	0.43	B-41
S-040705-JH-083	nd	B-41
S-040705-JH-084	0.69	B-51
S-040705-JH-085	0.84	B-51
S-040705-JH-086	19	B-51
S-040705-JH-087	4.6	B-51
S-040705-JH-088	0.54	B-51
S-040705-JH-089	nd	B-52
S-040705-JH-090	nd	B-52
S-040705-JH-091	nd	B-50
S-040705-JH-092	nd	B-48
S-040705-JH-093	nd	B-46
S-040705-JH-094	nd	B-47
S-040705-JH-095	nd	B-49
S-040705-JH-096	nd	B-36
S-040705-JH-097	1.1	B-36
S-040705-JH-098	1.9	B-36
S-040705-JH-099	0.58	B-36
S-040705-JH-100	nd	B-35
S-040705-JH-101	1.3	B-35
S-040705-JH-102	0.54	B-35
S-040705-JH-103	0.46	B-35

Caterpillar - Date? Sample Results (ppm)

Samples taken in Drum Storage Area

Sample Number	Comment	0-1 ft	1-2 ft	2-3 ft	3-4 ft	4-5 ft	5-6 ft	6-7 ft	7-8 ft	8-9 ft	9-10 ft	10-11 ft	11-12 ft	12-13 ft
K1				13			25							
K3					29			23						
K9							68		190	200				
K13						4.2								
K13A							24	28						
K13B							63	63	150	150				
K13C							42	41						
K17									71		0.5			
M3														
M7							17		29		320			
M11								55			20			
M15										38				
M19				66							51			
P3												20		
P9						26						31		
P15						100		72		110		59		
P19						200				3.4		140		
P23				160		220		84		43		38		
Q29					33								20	
Q34														3
T28				16						35		45		
T32													19	
T36					42	14							48	
T42												35		
T46						110						45		
U14					150					61		48		
U22					28		28			35	300		73	
U50					220								290	
W5														23
W9								<8						

Caterpillar - Date? Sample Results (ppm)

Samples taken in Drum Storage Area

Sample Number	Comment	0-1 ft	1-2 ft	2-3 ft	3-4 ft	4-5 ft	5-6 ft	6-7 ft	7-8 ft	8-9 ft	9-10 ft	10-11 ft	11-12 ft	12-13 ft
W13					82			47				46		
W25				19				36				47		
W30														
W39						120							5.4	
Y7											17			
Y19													49	
AA7											36			
AA13	Couldn't Reach Clay - Sand Heaving													
CC3													4.9	
CC7													18	
R13													22	
R19				0.64	9.8	14								
R19A						340	48							
R19B					87	17	55							
R19C					67	39	160	160	11					
R19D							38	110	44					
R19E					28	160								
R24													33	
H11								37		0.4				
H15								58		1.1				
L10										59				
L14									61		100			
EX1							< DL							

Caterpillar - April 7, 2005 Sample Results (ppm)

Sample Number	Results
S-040705-JH-076	nd
S-040705-JH-077	3.3
S-040705-JH-078	0.46
S-040705-JH-079	nd
S-040705-JH-080	nd
S-040705-JH-081	1.2
S-040705-JH-082	0.43
S-040705-JH-083	nd
S-040705-JH-084	0.69
S-040705-JH-085	0.84
S-040705-JH-086	19
S-040705-JH-087	4.6
S-040705-JH-088	0.54
S-040705-JH-089	nd
S-040705-JH-090	nd
S-040705-JH-091	nd
S-040705-JH-092	nd
S-040705-JH-093	nd
S-040705-JH-094	nd
S-040705-JH-095	nd
S-040705-JH-096	nd
S-040705-JH-097	1.1
S-040705-JH-098	1.9
S-040705-JH-099	0.58
S-040705-JH-100	nd
S-040705-JH-101	1.3
S-040705-JH-102	0.54
S-040705-JH-103	0.46

Caterpillar - March 1 and 2, 2005 Sample Results (ppm)

Sample Number	Results	Sample Number	Results	Sample Number	Results
S-030105-JH-001	16	S-030105-JH-026	nd	S-030105-JH-051	0.28/.056
S-030105-JH-002	29	S-030105-JH-027	3.3	S-030105-JH-052	nd
S-030105-JH-003	81	S-030105-JH-028	0.6	S-030105-JH-053	0.055
S-030105-JH-004	15	S-030105-JH-029	0.12	S-030105-JH-054	nd
S-030105-JH-005	17	S-030105-JH-030	0.28	S-030105-JH-055	nd
S-030105-JH-006	8.6	S-030105-JH-031	77	S-030105-JH-056	nd
S-030105-JH-007	nd	S-030105-JH-032	46	S-030105-JH-057	3.1
S-030105-JH-008	0.28	S-030105-JH-033	46	S-030105-JH-058	3.3
S-030105-JH-009	8.7	S-030105-JH-034	11	S-030105-JH-059	5
S-030105-JH-010	5.7	S-030105-JH-035	21	S-030105-JH-060	0.32
S-030105-JH-011	28	S-030105-JH-036	18	S-030105-JH-061	5.3
S-030105-JH-012	22	S-030105-JH-037	3.7	S-030105-JH-062	23
S-030105-JH-013	13	S-030105-JH-038	51	S-030105-JH-063	3
S-030105-JH-014	12	S-030105-JH-039	260	S-030105-JH-064	0.48
S-030105-JH-015	11	**S-030105-JH-040**	**1200**	S-030105-JH-065	2
S-030105-JH-016	0.14	S-030105-JH-041	4.9	S-030105-JH-066	4.5
S-030105-JH-017	nd	S-030105-JH-042	50	S-030105-JH-067	4.4
S-030105-JH-018	0.037	S-030105-JH-043	56	S-030105-JH-068	1.6
S-030105-JH-019	2.5	S-030105-JH-044	77	S-030105-JH-069	1.1
S-030105-JH-020	nd	S-030105-JH-045	0.07	S-030105-JH-070	1.9
S-030105-JH-021	nd	S-030105-JH-046	29	S-030105-JH-071	0.38
S-030105-JH-022	41	S-030105-JH-047	18	S-030105-JH-072	2.1
S-030105-JH-023	0.062	S-030105-JH-048	43	S-030105-JH-073	2.1
S-030105-JH-024	85	S-030105-JH-049	0.046	S-030105-JH-074	7.1
S-030105-JH-025	0.075	S-030105-JH-050	0.17	S-030105-JH-075	0.25

S-030105-JH-040 1200
Is it same as B-56 at 6-7 '?

Caterpillar - September 1999 Sample Results (ppm)

Samples taken between Building B and Little LaMarsh Creek

Sample Number	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-22	n/d	n/d	n/d	n/d		
B-23	n/d	n/d	n/d	n/d		
B-24	n/d	n/d	n/d	n/d		
B-25	n/d	0.36	0.84	0.64		
B-27	n/d	n/d	0.36	0.2		
B-28	0.2	0.17	n/d	0.043	.046	
B-29	n/d	n/d	0.43	0.58		
B-30	n/d	n/d	0.91	0.14		
B-31	n/d	0.48	0.65	0.043		
B-32	0.22	1.7	0.037	8.2		
B-33	n/d	0.36	0.59			
B-34	0.9	2.2	2.3			

Caterpillar - September 13 and 14, 1999 Sample Results (ppm)

Sample Number	Results	
S-091399-JH-082	0.068	
S-091399-JH-083	0.11	
S-091399-JH-084	0.16	
S-091399-JH-085	0.24	
S-091399-JH-086	1.3	
S-091399-JH-087	0.32	
S-091399-JH-088	0.55	
S-091399-JH-089	1.6	
S-091499-JH-090	nd	
S-091499-JH-091	nd	
S-091499-JH-092	nd	
S-091499-JH-093	nd	
S-091499-JH-094	nd	
S-091499-JH-095	nd	
S-091499-JH-096	nd	
S-091499-JH-097	nd	
S-091499-JH-098	nd	
S-091499-JH-099	nd	
S-091499-JH-100	nd	
S-091499-JH-101	nd	
S-091499-JH-102	nd	
S-091499-JH-103	0.36	
S-091499-JH-104	0.84	
S-091499-JH-105	0.64	
S-091499-JH-106	0.78	
S-091499-JH-107	0.12	
S-091499-JH-108	0.14	
S-091499-JH-109	0.049	
S-091499-JH-110	nd	
S-091499-JH-111	nd	
S-091499-JH-112	0.36	
S-091499-JH-113	0.245	
S-091499-JH-114	0.2	
S-091499-JH-115	0.17	
S-091499-JH-116	nd	
S-091499-JH-117	0.043	
S-091499-JH-118	0.046	
S-091499-JH-119	nd	
S-091499-JH-120	nd	
S-091499-JH-121	0.43	
S-091499-JH-122	0.58	
S-091499-JH-123	nd	
S-091499-JH-124	nd	
S-091499-JH-125	0.91	
S-091499-JH-126	0.14	
S-091499-JH-127	nd	
S-091499-JH-128	0.48	
S-091499-JH-129	0.065	
S-091499-JH-130	0.043	
S-091499-JH-131	nd	
S-091499-JH-132	0.36	
S-091499-JH-133	0.59	
S-091499-JH-134	0.9	
S-091499-JH-135	2.2	B34
S-091499-JH-136	2.3	
S-091499-JH-137	0.22	
S-091499-JH-138	1.7	B32
S-091499-JH-139	0.037	
S-091499-JH-140	8.2	

Caterpillar - September 1999 Sample Results (ppm)

Samples taken within Swale Area

Sample Number	Comment	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-20	All Under 1 ppm	0.068	0.11	0.16	0.24		
B-21		1.3	0.32	0.55	1.6		
B-26	All Under 1 ppm						

Caterpillar - April 2005 Sample Results (ppm)

Samples taken between Building B and Little LaMarsh Creek

Sample Number	0-2 feet	2-4 feet	4-6 feet	6-8 feet	8-10 feet	10-12 feet
B-35	n/d	1.3	0.54	0.46		
B-36	n/d	1.1	1.9	0.58		
B-37	0.32	5.3	23	3		
B-38	n/d	3.1	3.3	5		
B-39	0.48	2	4.5	4.4		
B-40	n/d	3.3	0.46	n/d		
B-41	n/d	1.2	0.43	n/d		
B-42	2.1	2.1	7.1	0.25		
B-43	1.6	1.1	1.9	0.38		
B-44	0.055	n/d				
B-45	n/d					
B-46	n/d					
B-47	n/d					
B-48	n/d					
B-49	n/d					
B-50	n/d					
B-51	0.69	0.84	19	4.6		0.54
B-52	n/d	n/d				

Caterpillar - Date? Sample Results (ppm)

Samples taken in Drum Storage Area

Sample Number	Comment	0-1 ft	1-2 ft	2-3 ft	3-4 ft	4-5 ft	5-6 ft	6-7 ft	7-8 ft	8-9 ft	9-10 ft	10-11 ft	11-12 ft	12-13 ft
K1				13			25							
K3					29			23						
K9							68		190	200				
K13						4.2								
K13A							24	28						
K13B							63	63	150	150				
K13C							42	41						
K17									71		0.5			
M3														
M7							17		29		320			
M11								55			20			
M15										38				
M19				66							51			
P3												20		
P9						26						31		
P15						100		72		110		59		
P19						200				3.4		140		
P23				160		220		84		43		38		
Q29					33								20	
Q34														3
T28				16						35		45		
T32													19	
T36					42	14							48	
T42												35		
T46						110						45		
U14					150					61		48		
U22					28		28			35	300		73	
U50					220								290	
W5														23
W9								<8						

Caterpillar - Date? Sample Results (ppm)

Samples taken in Drum Storage Area

Sample Number	Comment	0-1 ft	1-2 ft	2-3 ft	3-4 ft	4-5 ft	5-6 ft	6-7 ft	7-8 ft	8-9 ft	9-10 ft	10-11 ft	11-12 ft	12-13 ft
W13					82			47				46		
W25				19				36				47		
W30														
W39						120							5.4	
Y7											17			
Y19													49	
AA7											36			
AA13	Couldn't Reach Clay - Sand Heaving													
CC3													4.9	
CC7													18	
R13													22	
R19				0.64	9.8	14								
R19A						340	48							
R19B					87	17	55							
R19C					67	39	160	160	11					
R19D							38	110	44					
R19E					28	160								
R24													33	
H11								37		0.4				
H15								58		1.1				
L10										59				
L14									61		100			
EX1							< DL							